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Part 3 lists MIT classes, or subjects, grouped by course number.

MIT course numbers (and abbreviations) refer to courses of study leading to specific academic degrees and, by extension, to the departments or programs offering those degrees.

The subject descriptions in the printed Bulletin are accurate at the time of publication, but are subject to change. For current listings, consult the online Student Information System at http://student.mit.edu/catalog/index.cgi. The online information is updated as changes occur.

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How to Read Subject Descriptions

A subject description consists of four parts: subject name, subject information, subject content, and instructor(s).

Subject Name

The subject name consists of its number and title. J at the end of a subject number indicates that the subject is offered jointly by more than one department. Its subject numbers in the other departments are indicated in the subject information section. (New) following the subject number and title indicates a subject that is new to the catalogue.

Subject Information

The subject information section may include the following:

If a subject has been renumbered, its former number appears in parentheses.

If a subject is jointly offered or is a school-wide elective (SWE), the phrase Same subject as followed by the subject’s other number(s) appears in parentheses.

Meets with appears if the subject is taught together with one or more subjects at a different level, or if part of the subject is taught in conjunction with another subject. Subjects that meet together generally have different coursework requirements.

Prerequisites are listed in this section or are indicated below in the subject content section. Students who have not completed the stated prerequisites must obtain the instructor’s permission to register. Numbers in italics indicate co-requisites that may be taken simultaneously with the subject described. Prerequisites are listed before co-requisites. A dash (—) denotes that there are no prerequisites or coerequisites.

The use of “and” denotes that all of the subjects in a series are required, for example:

Prereq: 6.021J, 6.034, 6.046, and 18.417

The use of “or” denotes that just one of a series of prerequisites is required. When there are more than two options, commas are used, for example:

Prereq: 7.03, 7.05, 7.06, or 7.28

A semicolon is used to separate individual prerequisites from one of a series of prerequisites, or to separate several series of prerequisites, for example:

Prereq: 6.046; 6.041 or 6.042

Implicit prerequisites are not listed. For example, it is not necessary to list 18.01 as a prerequisite if 18.02 is already listed.

Acad Year may indicate 2007–2008: Not offered or 2008–2009: Not offered. There is no comment if the subject is offered in both academic years.

Subject level and term follow. U is an undergraduate subject, and G is a subject offered primarily to graduate students. IAP is MIT’s Independent Activities Period.

Credit units, which indicate a subject’s time distribution, are represented by three numbers separated by dashes. First is the number of units assigned for recitation and lecture; second, the number of units for laboratory, design, or fieldwork; and third, for preparation. Add the units together to obtain the total credit for a subject.

One unit represents approximately 14 hours of work. Units arranged indicates that units are specially arranged by the instructor.

Subjects fulfilling the General Institute Requirements, such as BIOLOGY, PHYSICS, CALC, CHEMISTRY, REST (Restricted Electives in Science and Technology), Institute LAB, or HASS-D (Humanities, Arts, and Social Sciences Distribution) are so designated to the right of the credit units.

The list of prerequisites may indicate:

H-LEVEL Grad Credit appears to the right of the credit units if the subject is graded on a P, D, or F basis (where P means C or better performance).

HASS-D Language Option indicates language subjects that may be substituted for one HASS-D subject.

[P/D/F] appears to the right of the credit units if the subject is graded on a P, D, or F basis (where P means C or better performance).

Subject Content

If a description of the subject content is not given, the associated subject number under which the content description can be found appears instead. Any subject open only to special groups is so noted at the end of its content description.

Instructor(s)

The name of the subject instructor(s) as known at the time of publication, or the name of the department contact, appears in italics at the end of the subject description.
1.011 Project Evaluation
Prereq: —
U (Spring)
3-0-6
Methodologies for evaluating civil engineering projects, which typically are large-scale, long-lived projects involving many economic, financial, social, and environmental factors. Basic techniques of engineering economics, including net present value analysis, life-cycle costing, benefit-cost analysis, and other approaches to project evaluation. Resource and cost estimation procedures appropriate for large-scale infrastructure systems. Examples drawn from building design and construction, transportation systems, urban development, environmental projects, water resource management, and other elements of both the public and private infrastructure.

1.012 Approaches to Civil and Environmental Engineering Design: Principles and Practice
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
1-2-3
Introduces students to the techniques, tools, and theory of engineering design and creative problem-solving, as well as design issues and practices in civil and environmental engineering. Includes several design cases. The design approaches explicitly consider technical issues as well as the existing built environment, natural environment, economic and social factors, and expected life span. A large design case is introduced which is used in subsequent specialty area design subjects and the capstone design subject (1.013). Students also start to develop their design portfolio.

1.013 Senior Civil and Environmental Engineering Design
Prereq: Permission of instructor
U (Spring)
2-4-8
The project synthesizes prior design education. Students who have specialized in structural, geotechnical, engineering systems and environmental areas form teams to design and plan a major project in a specific location. Students formulate the problem and demonstrate creativity in applying theories and methodologies from their design and analysis subjects to develop the facility, with consideration of its technical, environmental, and social feasibility. Parallel to this major design project are smaller projects involving actual building. Lectures on a variety of civil and environmental engineering projects as well as field trips are also part of the subject. Instruction and practice in oral and written communication provided.

H. H. Einstein, P. Shanahan, L. O’Donnell

1.015] Design of Systems Operating in Random Environments
(Same subject as 2.017)
Prereq: 2.003; 2.016 or 2.005; 2.671
U (Spring)
2-4-6
See description under subject 2.017.

M. S. Triantafyllou, F. S. Hover

1.016 Communicating Complex Environmental Issues: Designing and Building Interactive Museum Exhibits
Prereq: 12.000
U (Spring)
3-1-5
Provides an opportunity to develop additional depth of knowledge on issues related to the Earth System problem studied during the Fall term Terrascope subject, 12.000. Student teams conceptualize, design, prototype and execute interactive museum exhibits to articulate and communicate their knowledge of the subject. Concepts of design are developed with professionals from local museums. Products are open to the public. The Terrascope field trip provides first hand experience and shapes the final exhibit design. Limited to Terrascope students.

R. L. Bras, A. Epstein

1.018] Ecology I: The Earth System
(Same subject as 7.30)
Prereq: —
U (Fall)
3-1-8 REST
Fundamentals of ecology, considering Earth as an integrated dynamic system. Coevolution of the biosphere, geosphere, atmosphere and
oceans. Introduction to thermodynamics. The Earth’s energy budget. Photosynthesis and respiration. The hydrologic, carbon and nitrogen cycles. Flow of energy and materials through ecosystems, regulation of the distribution and abundance of organisms, structure and function of ecosystems. Evolution and natural selection; metabolic diversity; productivity. Trophic dynamics; models of population growth, competition, mutualism and predation. 7.012–7.015 recommended.

S. W. Chisholm, E. Delong

1.020 Ecology II: Engineering for Sustainability
Prereq: —
U (Spring)
3-2-7
Use of ecological and thermodynamic principles to examine interactions between humans and the natural environment. Fluxes and states, conservation and constitutive laws, chemical equilibrium and kinetics, life cycle analysis, economic methods for evaluating benefits and costs, externalities. Topics such as renewable energy, sustainable agriculture and green buildings illustrated through case studies. Case studies are team-oriented and may include numerical simulations and design exercises as well as reviews of relevant research. Instruction and practice in oral and written communication provided.

D. McLaughlin, D. Entekhabi, D. H. Marks

1.021 Introduction to Modeling and Simulation
Engineering School-Wide Elective Subject.
(Offered under: 1.021, 2.088, 3.021, 10.333, 18.361, 22.00, HST.558)
Prereq: 18.03
U (Spring)
3-0-9 REST
See description under subject 22.00.

M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Rodovitzky, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

1.032 Geomaterials and Geomechanics
(Subject meets with 1.361, 1.366)
Prereq: 1.010, 1.011, 1.035
U (Fall)
3-0-9
Presentation and application of principles of soil mechanics. Considers the topics: the origin and nature of soils; soil classification; the effective stress principle; hydraulic conductivity and seepage; stress-strain-strength behavior of cohesionless and cohesive soils and application to lateral earth stresses, bearing capacity and slope stability; consolidation theory and settlement analyses; laboratory and field methods for evaluation of soil properties in design practice. Same lectures as 1.361.

L. C. Jen

1.033 Mechanics of Material Systems: An Energy Approach
(Subject meets with 1.57)
Prereq: 1.030
U (Fall)
Next offered 2009–2010
3-2-7
Introduction to continuum mechanics and material modeling of engineering materials based on first energy principles: deformation and strain; momentum balance, stress and stress states; elasticity and elasticity bounds; plasticity and yield design. overarching theme is a unified mechanistic language using thermodynamics, which allows understanding, modeling and design of a large range of engineering materials.

F. J. Ulm

1.035 Mechanics of Structures and Soils
Prereq: 1.060, 1.050
U (Fall)
5-3-10

E. Kausel, A. J. Whittle, J. T. Germaine

1.036 Structural and Geotechnical Engineering Design
Prereq: 1.035
U (Spring)
3-1-8
Basic philosophy of planning and design of structures. Loading conditions, design criteria and factors of safety. Application of principles of structural mechanics and soil mechanics in design. Structural system design concepts. Design of reinforced concrete structural elements using the ultimate strength design method. Load factor design of structural steel members and connections. Selection of soil parameters from laboratory and in situ tests. Stability and ground deformations in geotechnical design. Design with soil-structure interaction. Emphasis on problem-based learning through team design projects.

O. Buyukozturk, A. J. Whittle

1.040 Project Management
(Subject meets with 1.401, ESD.018)
Prereq: —
U (Spring)
3-1-8
Introduction to project management for custom designed projects, including analytical techniques and practical applications. Topics include resource management, risk analysis and management, financial evaluation and controls, and construction management for all phases of facility life cycle. Experience with software tools and discussion of more novel techniques including risk management sensitivity analysis, process and system dynamics simulation. Visits to ongoing and completed projects. Meets with graduate subject 1.401; students taking the graduate version are expected to complete additional assignments.

Staff

1.041J Engineering System Design
(Same subject as ESD.01J)
Prereq: 1.011 or permission of instructor
U (Spring)
3-1-8
Deals with the design of complex, large, interconnected, open sociotechnical (CLIOS) systems, where “open” denotes systems that directly interact with the social/political/economic context. Introduces the CLIOS process, defining the concept and distinguishing between quantitative and qualitative analyses of such systems, including introductions of models and frameworks. Systems are characterized, measures of system performance are developed, and key CLIOS system concepts (including sustainability, equity, mobility, and accessibility) are introduced. Class-wide project, with students working in teams on the design of a CLIOS system, taking a broad systems perspective in that design. Examples include the urban ring, a proposed new transit line for Boston; Tren Urbano in San Juan, Puerto Rico; the Central Artery/Ted Williams Tunnel project in Boston; and the transportation of spent nuclear fuel.

J. Sussman
1.044J Fundamentals of Energy in Buildings
(Same subject as 2.66J, 4.42J)
Prereq: 8.01, 18.02
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-2-7 REST
See description under subject 4.42J.
L. R. Glicksman

1.053J Dynamics and Control II
(Same subject as 2.003J)
Prereq: 8.01, 18.03
U (Fall, Spring)
4-1-7 REST
See description under subject 2.003J.
N. G. Hadjiconstantinou, G. Haller, N. C. Makris,
N. M. Patrikalakis, T. Peacock

1.054 Mechanics and Design of Concrete Structures
(Subject meets with 1.541)
Prereq: 1.035
U (Fall)
3-0-9
Meets with graduate subject 1.541. Undergraduate level has the option of excluding special topics paper, but requires an assigned design project. See description under subject 1.541.
O. Buyukozturk

1.058J Mechanical Vibration
(Same subject as 2.06J)
Prereq: 2.003J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
4-0-8
See description under subject 2.06J.
E. A. Kausel, J. K. Vandiver

1.060 Engineering Mechanics II
Prereq: 18.03; 5.60
U (Fall)
Next offered: Acad Year 2009–2010
3-0-9
Introduces the basic relevant principles and concepts in atmospheric physics, climate dynamics, biogeochemistry, and water and energy balance at the land-atmosphere boundary, through an examination of two current problems in the global environment: carbon dioxide and global warming; and tropical deforestation and regional climate. An introduction to global environmental problems for students in basic sciences and engineering.
E. A. B. Eltahir

1.061 Transport Processes in the Environment
(Subject meets with 1.61)
Prereq: 1.060
U (Fall)
3-1-8
Introduction to mass transport in environmental flows, with emphasis given to river and lake systems. Derivation and solutions to the differential form of mass conservation equations. Topics include: molecular and turbulent diffusion, boundary layers, dissolution, bed-water exchange, air-water exchange and particle transport.
H. M. Nepf

1.070J Introduction to Hydrology
(Same subject as 12.320J)
Prereq: 1.060, 1.061, 1.106
U (Fall)
3-0-9
Introduction to the global water and energy cycles and the earth system including the atmosphere, oceans, land, and biosphere. Fundamentals of hydrologic science and its applications. Covers bases for the characterization of hydrologic processes such as precipitation, evaporation, transpiration by vegetation, infiltration, and storm runoff. Understanding and modeling of groundwater flow, hydraulics of wells, and subsurface transport of pollutants. Probabilistic analysis and risk estimation for hydrologic variables.
D. Entekhabi

1.071J Global Change Science
(Same subject as 12.300J)
Prereq: 18.03; 5.60
U (Fall)
Next offered: Acad Year 2009–2010
3-0-9
Introduces the basic relevant principles and concepts in atmospheric physics, climate dynamics, biogeochemistry, and water and energy balance at the land-atmosphere boundary, through an examination of two current problems in the global environment: carbon dioxide and global warming; and tropical deforestation and regional climate. An introduction to global environmental problems for students in basic sciences and engineering.
E. A. B. Eltahir

1.076J Physical Principles of Remote Sensing
(Same subject as 12.421J)
(Subject meets with 1.718J, 12.621J)
Prereq: 8.03
U (Fall)
3-0-9
See description under subject 12.421J.
R. P. Binzel
1.080 Environmental Chemistry and Biology
Prereq: 1.107; 5.111, 5.112, or 3.091; 7.012, 7.013, 7.014, or 7.015
U (Spring)
4-0-8
Covers basic environmental chemistry and biology with a focus on understanding the principles governing the function of both natural systems and systems perturbed or engineered by humans. Topics include acid-base, complexation, reduction/oxidation, precipitation, hydrolysis and sorption reactions, population growth and limiting factors, microbial community structure, and the interactions between microbes and their chemical environment. 1.018j is a suggested prerequisite.
M. F. Polz, Staff

1.081j Chemicals in the Environment: Epidemiology, Toxicology, and Public Health
(Same subject as 20.104j, ESD.053j)
Prereq: 5.112 or 3.091; 7.012, 7.013, 7.014, or 7.015
U (Spring)
4-0-8
See description under subject 20.104j.
W. Thilly

1.082j Air Pollution: Processes and Controls
Prereq: —
U (Spring)
3-0-9
Solving air pollution problems requires a multi-disciplinary approach. Effects of air pollutants on human health and the environment. Origins of atmospheric pollutants and methods to estimate emissions from anthropogenic sources. Atmospheric chemistry and pollutant removal processes. Meteorological phenomena and pollutant dispersion modeling. Laws and regulations to control air pollution. Technologies and methods used to control air pollution. Regional and global issues such as acid rain, ozone depletion, and global climate change.
Staff

1.083 Environmental Health Engineering
Prereq: 1.061, 1.080
U (Spring)
3-0-9
Consideration of human health issues associated with environmental engineering for air, land, and water systems; fate and transport of environmental contaminants; toxicology, exposure pathways, and risk assessment; treatment technology, and basis for environmental regulation of chemical exposure. Case studies illustrate concepts and issues.
P. Shanahan, Staff

1.084j Systems Microbiology
(Same subject as 20.106j)
Prereq: 5.111, 5.112 or 3.091; 7.012, 7.013, 7.014, or 7.015
U (Fall)
3-0-9
See description under subject 20.106j.
D. B. Schauer, E. DeLong

UNDERGRADUATE LABORATORY SUBJECTS

1.101 Introduction to Civil and Environmental Engineering Design I
Prereq: 1.018, 1.050
U (Fall)
1-3-2 1/2 Institute LAB
Project-oriented introduction to the principles and practice of engineering design. Design projects and exercises relating to the built and natural environments. Emphasis on achieving function and sustainability through choice of materials and processes, compatibility with natural cycles, and the use of active or adaptive systems. Development of hands-on skills, teamwork, and communication using both images and texts. Exercises and projects engage students in the building, implementation, and testing of their designs.
Staff

1.102 Introduction to Civil and Environmental Engineering Design II
Prereq: 1.060, 1.101 or permission of instructor
U (Spring)
1-3-2 1/2 Institute LAB
Continuation of 1.101 with emphasis on construction and deployment of designs. Performance testing used to determine if designs behave as expected. Further development of hands-on, teamwork and communication skills.
H. F. Hemond, J. Germaine, Staff

1.106 Environmental Fluid Transport Processes and Hydrology Laboratory
Prereq: 1.061, 1.070
U (Fall)
0-4-2 1/2 Institute LAB
Builds on the lecture subjects 1.061 and 1.070. Fundamentals of mass and flow measurements in field and laboratory settings, and application of these measurement techniques to analyze real and model environmental systems.
J. R. Williams

ENGINEERING INFORMATION SYSTEMS AND COMPUTATION

1.124j Foundations of Software Engineering
(Same subject as 2.091j, ESD.51j)
Prereq: 1.00 or knowledge of an object-oriented language
G (Fall)
3-0-9 H-LEVEL Grad Credit
Modern software development techniques for engineering and information technology. Design and development of component-based software (using C# and .NET); data structures and algorithms for modeling, analysis, and visualization; basic problem-solving techniques; web services; and the management and maintenance of software. Treatment of topics such as sorting and searching algorithms; and numerical simulation techniques. Foundation for in-depth exploration of image processing, computational geometry, finite element methods, network methods and e-business applications.
J. R. Williams

s u b j e c t s 1 . 0 4 4 j t o 1 . 1 2 4 j
1.125J Web System Architecting: Building Web Services
(Same subject as ESD.341J)
Prereq: 1.124J, 6.001
G (Spring)
3-0-9 H-LEVEL Grad Credit
Software architecture and design of web systems in the context of a start-up company. Targeted at future CTOs who must understand both the business and technical issues involved in architecting enterprise-scale web systems. Student teams confront technically challenging problems. Lectures and readings cover core database, XML, web server components and browser issues in a web service environment. Limited enrollment.
J. R. Williams

1.126J Pattern Recognition and Analysis
(Same subject as MAS.622J)
Prereq: A working knowledge of probability theory and linear algebra
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject MAS.622J.
R. W. Picard

1.128J Computational Geometry
(Same subject as 2.089J, 16.940J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.089J.
N. M. Patrikalakis, D. C. Gossard

ENGINEERING ANALYSIS

1.133 MEng Concepts of Engineering Practice
Prereq: —
G (Fall)
3-0-6 H-LEVEL Grad Credit
Core requirement for the MEng program designed to teach students about the roles of today's professional engineer and expose them to team-building skills through lectures, team workshops, and seminars. Topics include: written and oral communication, job placement skills, trends in the engineering and construction industry, risk analysis and risk management, managing public information, proposal preparation, project evaluation, project management, liability, professional ethics, and negotiation. Draws on relevant large-scale projects to illustrate each component of the subject. Grading is based on both individual and team exercises involving written and oral presentations. Limited to Course 1 MEng students.
E. E. Adams

1.138J Wave Propagation
(Same subject as 2.062J, 18.376J)
Prereq: 2.003J, 18.075
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.062J.
T. R. Akylas, C. C. Mei, R. R. Rosales
See also 1.351, 1.541, 1.56J, 1.63, 1.691.

ENGINEERING RISK ASSESSMENT AND PROBABILISTIC ANALYSIS

1.151J Probability and Statistics in Engineering
Prereq: —
G (Spring)
3-0-9 H-LEVEL Grad Credit
D. Veneziano

1.155J Engineering Risk-Benefit Analysis
Engineering School-Wide Elective Subject.
(Offered under: 1.155J, 2.963J, 3.577J, 6.938J, 10.816J, 16.862J, 22.82J, ESD.72J)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.72J.
G. E. Apostolakis
See also 1.203J.

TRANSPORTATION

1.200J Transportation Systems Analysis
(Same subject as 11.544J, ESD.21J)
Prereq: 1.010 and permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit
Problem-motivated introduction to methods, models and tools for the analysis and design of transportation networks including their planning, operations and control. Capacity of critical elements of transportation networks. Traffic flows and deterministic and probabilistic delay models. Formulation of optimization models for planning and scheduling of freight, transit and airline systems, and their solution using software packages. User- and system-optimal traffic
assignment. Control of traffic flows on highways, urban grids, and airspace.
C. Barnhart, A. R. Odoni

1.201 J Introduction to Transportation Systems
(Same subject as 11.545 J, ESD.210 J)
Prereq: Permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit
Introduces transportation as a complex sociotechnical system, stressing its social and economic aspects. Key issues shaping urban, intercity, and international passenger and freight transportation in the developed and developing world. Principles governing transportation planning, investment, operations and maintenance. Introduction to quantitative models and qualitative frameworks. System performance and level-of-service metrics and the determinants of transportation demand. Introduction to economic concepts central to transportation. Transportation services and facilities for various modes and intermodal operations.
J. Sussman, N. H. M. Wilson

1.202 J Demand Modeling
(Same subject as ESD.212 J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
Theory and application of modeling and statistical methods for analysis and forecasting of demand for facilities, services, and products. Topics include review of probability and statistics, estimation and testing of linear regression models, theory of individual choice behavior, generation, estimation, and testing of discrete choice models (including logit, nested logit, GEV, probit, and mixture models), estimation under various sample designs and data collection methods (including revealed and stated preferences), sampling, aggregate forecasting methods, and iterative proportional fitting and related methods. Lectures reinforced with case studies, which require specification, estimation, testing, and analysis of models using data sets from actual applications.
M. E. Ben-Akiva

1.203 J Logistical and Transportation Planning Methods
(Same subject as 6.281 J, 15.073 J, 16.76 J, ESD.216 J)
Prereq: 6.431
G (Fall)
3-0-9 H-LEVEL Grad Credit
Quantitative techniques of operations research with emphasis on applications in transportation systems analysis (urban, air, ocean, highway, and pickup and delivery systems) and in the planning and design of logistically oriented urban service systems (e.g., fire and police departments, emergency medical services, and emergency repair services). Unified study of functions of random variables, geometrical probability, multi-server queuing theory, spatial location theory, network analysis and graph theory, and relevant methods of simulation. Computer exercises and discussions of implementation difficulties.
R. C. Larson, A. R. Odoni, A. I. Barnett

1.204 J Computer Algorithms in Systems Engineering
Prereq: 1.001 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
G. Kocur

1.205 J Advanced Demand Modeling
(Same subject as ESD.213 J)
Prereq: 1.202 or permission of instructor
Acad Year 2007–2008: G (Fall) Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Advanced theories and applications of models for analysis and forecasting of users’ behavior and demand for facilities, services, and products. Topics vary each year and typically include linear and nonlinear latent variable models including structural equations and latent class models, estimation techniques with multiple data sources, joint discrete and continuous choice models, dynamic models, analysis of panel data, analysis of complex choices, estimation and forecasting with very large choice sets, multidimensional probabilistic choice models, advanced choice models including probit, logit mixtures, hybrid choice models, simulation methods, survey design, model transferability, and use of stated preference data. Alternate years.
M. E. Ben-Akiva

1.206 J Airline Schedule Planning
(Same subject as 16.77 J, ESD.215 J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Explores a variety of models and optimization techniques for the solution of airline schedule planning problems. Schedule design, fleet assignment, aircraft maintenance routing, crew scheduling, robust planning, integrated schedule planning, and other topics are addressed. Models and solution techniques are surveyed and state-of-the-art applications of these techniques to airline problems are presented.
C. Barnhart

1.212 J An Introduction to Intelligent Transportation Systems
(Same subject as ESD.221 J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
Basic elements of intelligent transportation systems. Technological, systems, and institutional aspects of ITS considered, including system architecture, congestion pricing, public/private partnerships, network models, freight, public transportation, ITS and regional strategic transportation planning, environmental aspects of ITS, developing country applications and implementation case studies. Term project required.
J. Sussman

1.231 J Planning and Design of Airport Systems
(Same subject as 16.781 J, ESD.224 J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall) Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Equal emphasis on current practice and advanced concepts. Airport location and planning with full consideration of economic, environmental, and other impacts. Demand prediction, determination of the capacity of the airfield, and estimation of levels of congestion. Design of terminals. Role of airports in the aviation and transportation system. Airport access problems. Optimal configuration of air transport networks and implications for airport development. Economics of the airport. Financing and institutional aspects. Special attention to international practice and developments. Alternate years.
R. de Neufville, A. R. Odoni
1.232| The Airline Industry  
(Same subject as 15.054J, 16.71J, ESD.217J)  
Prereq: —  
G (Fall)  
3-0-9  
See description under subject 16.71J.  
F. Salvucci, A. I. Barnett, C. Barnhart,  
R. J. Hansman, T. A. Kochan, A. R. Odoni  

1.234| Airline Management  
(Same subject as 16.75J)  
Prereq: 16.71J  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 16.75J.  
P. P. Belobaba  

1.251| Comparative Land Use and  
Transportation Planning  
(Same subject as 11.526J)  
Prereq: Permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 11.526J.  
C. Zegras  

1.252| Urban Transportation Planning  
(Same subject as 11.540J, ESD.225J)  
Prereq: Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 11.540J.  
F. Salvucci, M. Murga  

1.253| Transportation Policy and Environmental  
Limits  
(Same subject as 11.543J, ESD.222J)  
Prereq: Permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Through a combination of lectures, cases, and  
class discussions the subject examines the eco-

1.258| Public Transportation Systems  
(Same subject as 11.541J, ESD.226J)  
Prereq: 1.201J or permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Evolution and role of urban public transportation  
models, systems, and services, focusing on bus  
and rail. Description of technological character-

1.260| Logistics Systems  
(Same subject as 15.770J, ESD.260J)  
Prereq: Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
See description under subject ESD.260J.  
Y. Sheffi, C. Caplice  

1.261| Case Studies in Logistics and Supply  
Chain Management  
(Same subject as 15.771J, ESD.261J)  
Prereq: Permission of Instructor  
G (Spring)  
3-0-6 H-LEVEL Grad Credit  
See description under subject ESD.261J.  
J. Byrnes  

1.262| Supply Chain Context  
(Same subject as ESD.262J)  
Prereq: ESD.260 or permission of instructor  
G (IAP)  
2-0-4 [P/D/F]  
See description under subject ESD.262J.  
C. Caplice, J. Goentzel  

1.264| Database, Internet, and Systems  
Integration Technologies  
(Same subject as ESD.264J)  
Prereq: Permission of instructor  
G (Fall)  
4-1-7 H-LEVEL Grad Credit  
Information technology fundamentals: soft-
ware process, data modeling, UML, relational  
databases and SQL. Internet technologies:  
http, xhtml, XML, Web services. Introduction to  
security. Fundamentals of telecommunications.  
Students complete project that covers require-
m ents/design, data model, database implement-

1.265| International Supply Chain Management  
(Same subject as 2.965J, 15.765J, ESD.265J)  
Prereq: 1.260J, 1.261J, 1.262J, 15.760, or  
permission of instructor  
G (Spring)  
2-0-4 H-LEVEL Grad Credit  
An overview of globalization and the interna-
tional environment: the international marketing,  
international finance and supply chain interface;  
global strategy for logistics and supply chain  
management; global supply chain models; role  
of government intervention and regulations;  
the role of ports and airports in international  
product movements; the economics of interna-
tional air and ocean carriers; and the forwarding  
industry. First half term subject.  
H. S. Marcus, A. Weiss  

1.27| Studies in Transportation  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Individual advanced study of a topic in transpor-
tation systems, selected with the approval of the  
instructor.  
Staff  

1.270| Logistics and Supply Chain Management  
(Same subject as ESD.273J)  
Prereq: Probability and Linear Programming  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
3-0-9 H-LEVEL Grad Credit  
See description under subject ESD.273J.  
D. Simchi-Levi
GEOENVIRONMENTAL AND GEOTECHNICAL ENGINEERING

1.322 Soil Behavior
Prereq: 1.361
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8 H-LEVEL Grad Credit
Detailed study of soil properties with emphasis on interpretation of field and laboratory test data and their use in soft-ground construction engineering. Includes: consolidation and secondary compression; basic strength principles; stress-strain strength behavior of clays, emphasizing effects of sample disturbance, anisotropy, and strain rate; strength and compression of granular soils; and engineering properties of compacted soils. Some knowledge of field and laboratory testing assumed; 1.37 desirable. Alternate years.
A. J. Whittle, L. C. Jen

1.34 Waste Containment and Remediation Technology
Prereq: 1.72 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Hazardous waste site remediation and waste disposal facility design. Introduction to hazardous waste including the definition of hazardous waste, regulatory requirements under RCRA and CERCLA, waste characteristics, environmental chemistry, hydrology, and contaminant transport. Characterization of contaminated sites, preliminary site assessment, site investigation techniques, remediation technologies for soil and groundwater, risk assessment, and monitoring. The design, construction, operation, and hydrology of landfills and waste disposal facilities.
P. Shanahan

1.351 Theoretical Soil Mechanics
Prereq: 1.361
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
A. J. Whittle

1.361 Advanced Soil Mechanics
Prereq: 1.031, 1.366
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.032.
L. C. Jen

1.364 Advanced Geotechnical Engineering
Prereq: 1.031, 1.361
G (Fall)
4-0-8 H-LEVEL Grad Credit
Site characterization and geotechnical aspects of the design and construction of foundation systems. Topics include site investigation (with emphasis on in situ testing), shallow (footings and raftings) and deep (piles and caissons) foundations, excavation support systems, groundwater control, slope stability, soil improvement (compaction, soil reinforcement, etc.), and construction monitoring. Core requirement for Geotechnical MEng program.
A. J. Whittle

1.366 Geotechnical Engineering
Prereq: 1.032, 1.361
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject 1.032.
L. C. Jen

1.37 Geotechnical Measurements and Exploration
Prereq: 1.031
G (Fall)
3-4-2 H-LEVEL Grad Credit
Application of testing principles to the measurement of fundamental aspects of soil behavior from classification to engineering properties. Emphasis on rigorous techniques to measure mechanical behavior under various boundary conditions. Exposure to error estimation, research devices, geotechnical field exploration, and in situ testing. Extensive laboratory experiments to explore geotechnical test equipment and techniques. Laboratory use of testing automation and electronic instrumentation. Experiments include data analysis, evaluation, and presentation.
J. T. Germaine
1.38 Engineering Geology
Prereq: Permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit

Effect of geologic features and processes on constructed facilities; interaction between man-made structures and human activities in general, and the geologic environment. Planning of subsurface exploration. Engineering geologic characterization of soil and rock, including joint surveys and aspects of sedimented and residual soils. Laboratory on basic geologic identification and mapping techniques. Extensive reading of case histories. Field trip.
H. H. Einstein

1.381 Rock Mechanics
Prereq: 1.38, 1.361
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit

Introduces theoretical and experimental aspects of rock mechanics and on this basis prepares the student for rock engineering. Includes review of laboratory and field testing; empirical and analytical methods for describing strength, deformability, and permeability of intact rock and rock masses; fracture mechanics and mechanics of discontinua including flow through discontinua; design and analysis of rock slopes and foundations on rock; and discussion of blasting design. Alternate years.
H. H. Einstein

1.383 Underground Construction
Prereq: 1.361, 1.38, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit

Familiarization with the most important aspects of planning, design, and construction of underground openings in soft ground and rock. Detailed engineering analysis and design. Major aspects of construction techniques and construction planning. General planning and economic problems. Major design project. Alternate years.
H. H. Einstein

1.39 Studies in Geotechnical Engineering
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

For graduate students desiring further individual study of special topics.
Information: A. J. Whittle

CONSTRUCTION ENGINEERING AND MANAGEMENT

1.401J Project Management
(Same subject as ESD.018J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit

Introduction to theories of project management, with practical application through case projects. Topics include resource management, financial controls, and construction management (including scheduling, estimating, progress monitoring, and project control) for all phases of expected life of facility. Meets with undergraduate subject 1.040; students taking the graduate version are expected to complete additional assignments.
Staff

1.45J International Construction Finance
(Same subject as 11.341J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 11.341J.
M. V. Samii

1.46J Strategic Leadership in Real Estate and Construction
(Same subject as 11.348J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 11.348J.
J. Macomber

1.462J Entrepreneurship in Construction and Real Estate Development
(Same subject as 11.345J)
Prereq: Permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit

See description under subject 11.345J.
J. F. Kennedy

1.463J The Impact of Globalization on the Built Environment
(Same subject as 11.342J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 11.342J.
D. Wolff

1.464J E-Commerce and the Internet in Real Estate and Construction
(Same subject as 11.343J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 11.343J.
J. Macomber

1.472J Innovative Project Delivery in the Public and Private Sectors
(Same subject as 11.344J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 11.344J.
C. M. Gordon

MATERIALS AND STRUCTURES

1.541 Mechanics and Design of Concrete Structures
(Subject meets with 1.054)
Prereq: 1.051
G (Fall)
3-0-9 H-LEVEL Grad Credit

O. Buyukozturk
1.561 Motion-Based Design
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Presents a rational basis for the preliminary design of motion-sensitive structures. Topics include: analytical and numerical techniques for establishing the optimal stiffness distribution, the role of damping in controlling motion, tuned mass dampers, base isolation systems, and an introduction to active structural control. Examples illustrating the application of the motion-based design paradigm to building structures subjected to wind and seismic excitation are discussed.

J. J. Connor, Jr.

1.562 High-Performance Structures MEng Project
Prereq: 1.561 and 1.583
G (Fall), IAP (Spring)
5-0-10 H-LEVEL Grad Credit
Core requirement for the High Performance Structures MEng program. Focus on the conceptual design of complex structures and the use of advanced technologies to improve the performance of structural systems with respect to their durability, constructability, efficiency and sustainability. An in-depth design study is carried out as a group effort and provides the background for individual student theses. Students must register for 1.562 for the Fall term, IAP, and the Spring term. Limited to Course 1 MEng students.

J. J. Connor, Jr.

1.57 Mechanics of Material Systems: An Energy Approach
(Subject meets with 1.033)
Prereq: 1.035
G (Fall)
Next offered 2009–2010
3-2-7 H-LEVEL Grad Credit
See description under subject 1.033. An opportunity to update knowledge in continuum mechanics and constitutive behavior and modeling of engineering materials based on thermodynamics of irreversible processes. Graduate students are expected to complete additional assignments.

F. J. Ulm

1.570 Durability Mechanics
Prereq: 1.033/1.57
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduction to the theory and applications of durability mechanics based on first energy principles: damage and fracture mechanics; chemomechanics, poromechanics; and coupled diffusion and dissolution processes in porous materials. Analytical and numerical methods in durability mechanics such as dimensional analysis, scaling, finite difference, finite volume and finite element method, are also discussed. Development of a research paper on design, prediction, and optimization of durability performance of engineering structures.

F. J. Ulm

1.571 Structural Analysis and Control
Prereq: 1.052
G (Fall)
3-0-9 H-LEVEL Grad Credit

J. J. Connor, Jr.

1.572 Structural Systems (New)
Prereq: Permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit
Provides an understanding of the full range of structures and structural forms including both how they are designed and how they are built. The skills to conceive a structure differ from those required for analysis, requiring one to visualize options and judge their relative advantages in a qualitative manner. Design and assembly, in turn, require an understanding of how the structure is created. Structural types, including tall buildings, bridges, and kinetic/deployable structures, are presented with case studies of built structures.

P. Kassabian

1.573 Structural Mechanics
(Same subject as 2.080)
Prereq: 2.002 or 2.012
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 2.080.

T. Wierzbicki, J. J. Connor, Jr.

1.581 Advanced Structural Dynamics
(Same subject as 2.060, 16.221)
Prereq: 18.03, 1.573
G (Fall)
3-1-8 H-LEVEL Grad Credit

E. Kausel, J. K. Vandiver

1.582 Design of Steel Structures (New)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
Provides ability to design and assess steel structures. Steel structures are taught at three levels: the overall structural system (multi-story buildings, wide-span buildings, bridges, masts, and towers); the components of a structural system (floor systems, plate girders, frames, and beams); and the details of structural components (connection types, welding, and bolting). Each level includes a balance among theoretical analysis, design requirements, and construction/cost considerations. Existing structures are used as worked examples.

P. Kassabian

1.588J Communicating About Technology: Colossal Failures in Engineering (New)
(Same subject as 2.080, 22.002, 21W.781, ESD.032)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
See description under subject 21W.781.

T. Eagar, W. Hoas, A. Kadak, P. Lagacé
1.589 Studies in Structural Design and Analysis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Individual study of advanced subjects under staff supervision. Content arranged to suit the particular requirements of the student and interested members of the staff.
Information: O. Buyukozturk

1.597 Studies in Construction Materials
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Advanced topics in construction materials selected by students for individual study with staff supervision. Content arranged to suit the particular requirements of the student and interested members of the staff.
Information: O. Buyukozturk

HYDRODYNAMICS AND COASTAL ENGINEERING

1.61 Transport Processes in the Environment
(Subject meets with 1.061)
Prereq: 1.060
G (Fall)
3-1-8
See description under subject 1.061. Graduate level includes additional homework in the form of reviews of relevant journal and practical articles.
H. M. Nepf

1.63J Fluid Dynamics
(Same subject as 2.21J)
Prereq: 18.085 or 1.131J; 2.25 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Fundamentals of fluid dynamics intrinsic to natural physical phenomena and/or engineering processes. A range of topics and advanced problem-solving techniques discussed. Sample topics include brief review of basic laws of fluid motion, scaling and approximations, creeping flows, boundary layers in high-speed flows, steady and transient, similarity method of solution, buoyancy-driven convection in porous media, dispersion in steady or oscillatory flows, physics and mathematics of linearized instability, effects of shear and stratification. Choice of one of the following modules: I: capillary phenomena or non-Newtonian fluid (for 2.21J) or II: geophysical fluid dynamics of coastal waters (for 1.63J).
C. C. Mei, G. H. McKinley, T. R. Akylas, R. Stocker

1.64 Physical Limnology
Prereq: 1.060, 1.061
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit
Introduction to physical processes occurring in lakes and shallow surface water systems with emphasis on mechanisms affecting fate and transport. Topics include internal waves; differential heating and cooling; boundary mixing; turbulent mixing; influence of vegetation. Begins with a review of Navier-Stokes equation.
H. M. Nepf

1.66 Problems in Water Resources and Environmental Engineering
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Individual study in advanced topics as arranged between individual students and staff. Choice of subjects from theoretical, experimental, and practical phases of hydromechanics, hydraulic engineering, water resources, hydrology, and environmental engineering.
Staff

1.67 Sediment Transport and Coastal Processes
Prereq: 1.061, 1.69
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit
Emphasizes the quantitative description of the mechanics of sediment transport in steady and unsteady flows based on hydrodynamic principles. Equations of motion for particles in a turbulent flow, entrainment, bedload, and suspended load. Bedform mechanics, ripples, and dunes. Flow resistance and boundary-layer mechanics for waves and combined wave-current flows. Wave-induced longshore currents, longshore and on-offshore sediment transport. Coastal protection. Basic theory of water waves assumed known; contact instructor in late August if this presents a problem.
O. S. Madsen

1.685J Nonlinear Dynamics and Waves
(Same subject as 2.034J, 18.377J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.034J.
T. R. Akylas, C. Mei, R. R. Rosales

1.69 Introduction to Coastal Engineering
Prereq: 1.061
G (Fall)
4-0-8 H-LEVEL Grad Credit
O. S. Madsen

1.691J Surface Wave Dynamics
(Same subject as 2.064J)
Prereq: 1.060, 2.25 or 13.012; 1.131 or 18.075; or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
C. C. Mei, T. R. Akylas
**1.699J** Special Projects in Oceanographic Engineering  
(Same subject as 2.689J)  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
See description under subject 2.689J.  
T. K. Stanton, Woods Hole Staff

**HYDROLOGY AND WATER RESOURCE SYSTEMS**

**1.713J** Land-Atmosphere Interaction  
(Same subject as 12.826J)  
Prereq: 1.070J, 1.714, or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Exchange of mass, heat, and momentum between the soil, vegetation, or water surface and the overlying atmosphere; atmospheric boundary layer dynamics; coupled balance of moisture and energy. Hydrothermal flux and storage in unsaturated porous media. Evaporation, infiltration, and hillslope hydrologic processes. Diagnostics of global cycles of water and energy. Remote sensing and in situ measurement techniques. Data assimilation approaches to retrieval based on remotely sensed data.  
E. A. B. Eltahir

**1.714 Surface Hydrology**  
Prereq: 1.070J  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Covers observations and theory of the physical processes involved in the hydrologic cycle. Processes considered are rainfall, infiltration, runoff generation, streamflow, evaporation, transpiration, and rainfall interception.  
E. A. B. Eltahir

**1.715 Environmental Data Analysis**  
Prereq: 1.010  
Acad Year 2007–2008: G (Fall)  
Acad Year 2008–2009: Not offered  
3-0-9  
Covers probabilistic concepts and techniques that are useful for environmental data analysis. Topics include: random variables; hypothesis testing; linear regression; analysis of trends; space/time domain analysis; frequency domain analysis; simulation of random fields; Markovian processes; derived distributions; and stochastic differential equations. Problem sets emphasize environmental applications.  
E. A. B. Eltahir

**1.717J Techniques in Remote Sensing**  
(Same subject as 12.265J)  
Prereq: Permission of instructor  
Acad Year 2007–2008: U (IAP)  
Acad Year 2008–2009: Not offered  
1-4-1 [P/D/F]  
See description under subject 12.265J.  
M. Zuber

**1.718J Physical Principles of Remote Sensing**  
(Same subject as 12.621J)  
Prereq: 1.076J, 12.421J  
Acad Year 2007–2008: G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater. Topics include: Darcy equation, flow nets, mass conservation, the aquifer flow equation, heterogeneity and anisotropy, storage properties, regional circulation, unsaturated flow, recharge, stream-aquifer interaction, well hydraulics, flow through fractured rock, numerical models, groundwater quality, contaminant transport processes, dispersion, decay, and adsorption. Includes laboratory and computer demonstrations. Core requirement for Environmental and Geoenvironmental ME programs.  
C. Harvey

**1.721 Advanced Subsurface Hydrology**  
Prereq: 1.72, 18.075, permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
C. Harvey

**1.725J Chemicals in the Environment: Fate and Transport**  
(Same subject as ESD.151J)  
Prereq: Permission of instructor  
G (Fall)  
3-0-9  
For Institute students in all departments interested in the behavior of chemicals in the environment (see ESD listings for other subjects). Emphasis on man-made chemicals, their movement through water, air, soil, and their eventual fate. Physical transport, as well as chemical and biological sources and sinks, are discussed. Linkages to health effects, sources and control, and policy aspects. Core requirement for Environmental ME program.  
P. Shanahan

**1.731J Water Resource Systems**  
Prereq: 1.070 or permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Survey of simulation and optimization methods for management of water resources. Linear, nonlinear, and dynamic programming illustrated with case studies. Applications include reservoir and irrigation development, conjunctive use of surface and groundwater, capacity expansion, and sustainable resource development.  
D. McLaughlin

**1.733J Geological Image Interpretation**  
(Same subject as 12.462J)  
Prereq: 12.001 or 1.32; 12.421J or permission of instructor  
Acad Year 2007–2008: G (Spring)  
Acad Year 2008–2009: Not offered  
3-3-6 H-LEVEL Grad Credit  
See description under subject 12.462J.  
K. Whipple

**AQUATIC SCIENCES, WATER QUALITY CONTROL, AND ENVIRONMENTAL MANAGEMENT**

**1.75 Limnology and Wetland Ecology**  
Prereq: Permission of instructor  
Acad Year 2007–2008: G (Fall)  
Acad Year 2008–2009: Not offered  
3-0-9 H-LEVEL Grad Credit  
Examines the major physical, chemical, and biological features of lakes and wetlands: basin geology, water budget, heat balance, thermal stratification, lake circulation, energy flow, biological communities, and cycles of major...
elements. Explores methodologies of limnology, including field methods and use of models, applications of modern sensor technology to lake and wetland studies and current issues in lake and wetland management. Alternate years.

H. F. Hemond

1.76 Aquatic Chemistry
Prereq: 5.11, 5.111, 5.112, or 5.60
G (Fall)
3-0-9 H-LEVEL Grad Credit
Quantitative treatment of chemical processes in aquatic systems such as lakes, oceans, rivers, estuaries, groundwaters, and wastewaters. A brief review of chemical thermodynamics is followed by discussion of acid-base, precipitation-dissolution, coordination, and reduction-oxidation reactions. Emphasis is on equilibrium calculations as a tool for understanding the variables that govern the chemical composition of aquatic systems and the fate of inorganic pollutants.

Staff

1.77 Water Quality Control
Prereq: 1.060
G (Spring)
3-0-9 H-LEVEL Grad Credit
Emphasis on mathematical models for predicting distribution and fate of effluents discharged into lakes, reservoirs, rivers, estuaries, and oceans. Focuses on formulation and structure of models as well as analytical and simple numerical solution techniques. Role of element cycles, such as oxygen, nitrogen, and phosphorus, as water quality indicators. Offshore outfalls and diffusion. Salinity intrusion in estuaries. Thermal stratification, eutrophication, and sedimentation processes in lakes and reservoirs. Core requirement for Environmental MEng program.

E. E. Adams

1.782 Environmental Engineering MEng Project
Prereq: Permission of instructor
G (Fall, IAP, Spring)
5-0-10 H-LEVEL Grad Credit
Core requirements for Environmental MEng program. Designed to teach about environmental engineering through the use of case studies, computer software tools, and seminars from industrial experts. Case studies provide basis for group project as well as individual thesis. Past case studies have included the MMR Superfund site on Cape Cod; restoration of the Florida Everglades; dredging of Boston Harbor; local watershed trading programs; appropriate wastewater treatment technology for Brazil; point-of-use water treatment for Nepal, Brownfields Development in Providence, RI, and water resource planning for the island of Cyprus. Students must register for 1.782 for Fall term, IAP, and Spring term. Limited to Course 1 MEng students.

E. E. Adams

1.801j Environmental Law, Policy, and Economics: Pollution Prevention and Control (New)
(Same subject as 11.021J, 17.393J)
(Subject meets with 1.811J, 11.630J, ESD.133J)
Prereq: —
U (Fall)
3-0-9 HASS
Introduction to important issues in contemporary environmental law, policy, and economics. Discuss the roles and interactions of Congress, federal agencies, state governments, and the courts in dealing with environmental problems. Topics include common law, administrative law, environmental impact assessments required by the National Environmental Policy Act, and legislation and court decisions dealing with air pollution, water pollution, the control of hazardous waste, pollution and accident prevention, community right-to-know, and environmental justice. Explore the role of science and economics in legal decisions, and economic incentives as an alternative or supplement to regulation. Analyzes pollution as an economic problem and a failure of markets. Introduction to basic legal skills: how to read and understand cases, regulation, and statutes; how to discover the current state of the law in a specific area; and how to take action toward resolution of environmental problems.

N. Ashford, C. C. Caldart

1.802j Regulation of Chemicals, Radiation, and Biotechnology (New)
(Same subject as 11.022J)
(Subject meets with 1.812J, 11.631J, ESD.134J)
Prereq: —
U (Spring)
3-0-9
Focuses on policy design and evaluation in the regulation of hazardous substances and processes. Includes risk assessment, industrial chemicals, pesticides, food contaminants, pharmaceuticals, radiation and radioactive wastes, product safety, workplace hazards, indoor air pollution, biotechnology, victims’ compensation, and administrative law. Health and economic consequences of regulation, as well as its potential to spur technological change, are discussed.

N. Ashford, C. C. Caldart

1.811j Environmental Law, Policy, and Economics: Pollution Prevention and Control (Same subject as 11.630J, ESD.133J)
Prereq: Permission of instructor for undergraduates
G (Fall)
3-0-9 H-LEVEL Grad Credit
Reviews and analyzes federal and state regulation of air and water pollution and hazardous wastes. Analyses pollution as an economic problem and the failure of markets. Emphasizes use of legal mechanisms and alternative approaches (such as economic incentives and voluntary approaches) to control pollution and to encourage chemical accident and pollution prevention. Focuses on the major federal legislation, the underlying administrative system, and the common law in analyzing environmental policy, economic consequences, and the role of the courts. Discusses classical pollutants and toxic industrial chemicals, community right-to-know, and environmental justice. Also provides an introduction to basic legal skills.

N. A. Ashford, C. C. Caldart

1.812j Chemicals, Radiation, and Biotechnology
(Same subject as 11.631J, ESD.134J)
(Subject meets with 1.802J, 11.022J)
Prereq: Permission of instructor for undergraduates
G (Spring)
3-0-9 H-LEVEL Grad Credit
Focuses on policy design and evaluation in the regulation of hazardous substances and processes. Includes risk assessment, industrial chemicals, pesticides, food contaminants, pharmaceuticals, radiation and radioactive wastes, product safety, workplace hazards, indoor air pollution, biotechnology, victims’ compensation, and administrative law. Health and economic consequences of regulation, as well as its potential to spur technological change, are discussed.

N. A. Ashford, C. C. Caldart

1.813j Sustainability, Trade, and the Environment
(Same subject as 11.466J, 15.657J, ESD.137J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.137J.

N. A. Ashford
1.814| Industrial Ecology
(Same subject as 3.560, ESD.123)
Prereq: ESD.10 or 3.56
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject ESD.123.
R. Kirchain, J. Clark, F. Field

1.817| Planning, Participation and Consensus
Building for Sustainable Development
(Same subject as 11.366)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 11.366.
D. Fairman

1.818| Sustainable Energy
(Same subject as 2.65, 10.391, 11.371, 22.811, ESD.166)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject 10.391.
M. W. Golay, J. W. Tester, J. P. Freidberg

1.819| Design for Sustainability (New)
(Same subject as 4.447)
Prereq: Permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit
Teaches thought processes and quantitative
tools, including life cycle assessment (LCA)
and the LEED rating system, applicable to
integrated/whole building design with the goal
of minimizing the waste of materials, energy
and water. Readings, lectures, site visits, and
homework encourage systematic thinking and
interdisciplinary collaboration to make sustain-
able design a reality. Includes a team project of
students’ choice, such as a conceptual design of
a sustainable new building, a ‘green’ retrofit, or
a comparative LCA.
J. Connor, J. Ochsendorf, E. Adams

1.82| Problems in Environmental Microbiology
and Chemistry
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Advanced topics in environmental microbiology,
ecological genomics, microbial evolution and
population genetics, oceanography, biogeo-
chemical processes, environmental organic
chemistry and aquatic chemistry. Includes
independent study, seminar, laboratory, or field
studies.
S. W. Chisholm, E. DeLong, M. F. Polz, E. J. Alm,
J. Thompson, P. M. Gschwend, H. F. Hemond

1.83| Environmental Organic Chemistry
(Same subject as 1.831)
Prereq: 5.60, 18.03
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 1.831.

1.831| Environmental Organic Chemistry
(Same subject as 1.83)
Prereq: 5.60, 18.03
G (Fall)
4-0-8
Focuses on the processes affecting organic
compounds in the environment. Uses physical
chemical properties to predict chemical transfers
between environmental compartments (air,
water, sediments, and biota). Uses molecular
structure-reactivity relationships to estimate
chemical, photochemical, and biochemical
transformation rates. Resulting process models
are combined to predict environmental concen-
trations (and related biological exposures) of
anthropogenic and natural organic compounds.
Graduate students taking 1.83 for H-level credit
have additional reading and homework empha-
sizing structure-activity relationships.
P. M. Gschwend

1.85| Water and Wastewater Treatment
Engineering
Prereq: 1.061, 1.61, or 1.725
G (Fall)
3-0-9
Overview of engineering approaches to protect
water quality with an emphasis on fundamental
principals. Theory and conceptual design of
systems for treating municipal wastewater and
drinking water. Reactor theory, process kinetics,
and models. Physical, chemical, and biological
processes, including sedimentation, filtration,
biological treatment, disinfection, and sludge
processing. Engineered and natural processes
for wastewater treatment.
P. Shanahan

1.851| Water and Sanitation Infrastructure in
Developing Countries
(Same subject as 11.479)
Prereq: —
G (Spring)
Units arranged
See description under subject 11.479.
Consult Department Headquarters

1.89| Environmental Microbiology
Prereq: 7.014
G (Fall)
3-0-9 H-LEVEL Grad Credit
A general introduction to the diverse roles of
microorganisms in natural and artificial environ-
ments. Topics include: cellular architecture,
energetics, and growth; evolution and gene
flow; population and community dynamics;
water and soil microbiology; biogeochemical
cycling; and microorganisms in biodeterioration
and bioremediation.
M. F. Polz

SPECIAL STUDIES

1.961–1.966 Special Graduate Studies in Civil
and Environmental Engineering
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Graduate subjects taught experimentally;
special subjects offered by visiting faculty,
and seminars on topics of current interest.
Consult Department Academic Programs Office

1.968| Graduate Studies in Civil and
Environmental Engineering
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
1.969| Graduate Studies in Civil and
Environmental Engineering
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Individual study, research, or laboratory inves-
tigations at the graduate level under faculty
supervision.
Consult Department Academic Programs Office
1.970–1.977 Special Graduate Studies in Civil and Environmental Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

1.978–1.979 Special Graduate Studies in Civil and Environmental Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

Graduate subjects taught experimentally; special subjects offered by visiting faculty; and seminars on topics of current interest. 1.978 is taught P/D/F.
Consult Department Academic Programs Office

1.982 Research in Civil and Environmental Engineering
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

For research assistants in the department, when assigned research is not used for thesis but is approved for academic credit. Credit for this subject may not be used for any degree granted by Course 1.
Consult Department Academic Programs Office

1.983 Teaching in Civil and Environmental Engineering
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

For teaching assistants to recognize the educational value derived from satisfactory performance of assigned duties and for other qualified students interested in teaching as a career. Laboratory, tutorial, or classroom teaching under supervision of a faculty member. Credit for this subject may not be used for any degree granted by Course 1.
Consult Department Academic Programs Office

1.984 Teaching Experience in Environmental Engineering
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

For qualified graduate students interested in teaching. Tutorial, laboratory, or classroom teaching under the supervision of a faculty member. Total enrollment limited by availability of suitable teaching assignments.
Information: O. S. Madsen

1.991, 1.992 Special Undergraduate Studies in Civil and Environmental Engineering
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

Subjects taught experimentally; special subjects offered by visiting faculty; and seminars on topics of current interest. 1.991 is taught P/D/F.
Consult Department Academic Programs Office

1.993–1.995 Special Undergraduate Studies in Civil and Environmental Engineering
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Subjects taught experimentally; special subjects offered by visiting faculty; and seminars on topics of current interest. 1.995 is graded. Other numbers are taught P/D/F.
Consult Department Academic Programs Office

1.999 Undergraduate Studies in Civil and Environmental Engineering
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

Individual study, research, or laboratory investigations under faculty supervision.
Consult Department Academic Programs Office

1.EPE UPOP Summer Practice Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPE, 2.EPE, 3.EPE, 10.EPE, 16.EPE, 22.EPE)
Prereq: 2.EPW or permission of instructor
U (Fall, Spring)
0-1-0 [P/D/F]
Can be repeated for credit
See description under subject 2.EPE.
D. K. P. Yue

1.EPR UPOP Reflective Learning Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPR, 2.EPR, 3.EPR, 10.EPR, 16.EPR, 22.EPR)
Prereq: 2.EPE or permission of instructor
U (Fall)
0-0-3 [P/D/F]
See description under subject 2.EPR.
D. K. P. Yue

1.EPW UPOP IAP Workshop
Engineering School-Wide Elective Subject.
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW, 10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]
See description under subject 2.EPW.
D. K. P. Yue

1.THG Graduate Thesis
Prereq: —
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research leading to the writing of an SM, MEng, CE, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member.
Consult Department Academic Programs Office

1.THU Undergraduate Thesis
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Program of research leading to the writing of an SB thesis; to be arranged by the student and an appropriate MIT faculty member. Intended for seniors. Student must submit an approved thesis proposal to the Academic Programs Office by the fifth week of the first term the student is registered for thesis.
Consult Department Academic Programs Office

1.UR Research in Civil and Environmental Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

1.URG Research in Civil and Environmental Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Individual research or laboratory study under faculty supervision. Also opportunities in ongoing research program.
Consult Department Academic Programs Office
FRESHMAN YEAR
INTRODUCTORY SUBJECTS

2.00A Fundamentals of Engineering Design: Explore Space, Sea and Earth
(Same subject as 16.00A)
Prereq: 8.01, 18.01
U (Spring)
3-3-3

Students teams formulate and complete space/earth/ocean exploration-based design projects with weekly milestones. Introduces core engineering themes, principles, and modes of thinking. Specialized learning modules enable teams to focus on the knowledge required to complete their projects, such as machine elements, electronics, design process, visualization and communication. Includes exercises in written and oral communication and team building. Examples of projects include surveying a lake for millfoil, from a remote controlled aircraft, and oral communication and team building. Includes exercises in written and oral communication and team building. Limited enrollment. Preference to freshmen.


2.008 Solving Real Problems
Prereq: —
U (Spring)
2-3-4

Solve real problems in a project-centric class with 5 labs, each focusing on a different project theme and working directly with the potential beneficiaries of your work. Improve problem-solving skills while working on projects ranging from toys for children to amusement park rides and products for use in developing countries. Students select a project-themed lab in conjunction with subject. Develop creativity, visualization, mathematical estimation and modeling, prototyping, and team management techniques that help with the project. Includes exercises in written and oral communication and team building. Limited enrollment. Preference to freshmen.

D. R. Wallace

CORE UNDERGRADUATE SUBJECTS

2.001 Mechanics and Materials I
Prereq: 8.01, 18.02, 18.03
U (Fall, Spring)
3-2-7 REST

Introduction to statics and the mechanics of deformable solids. Emphasis on the three basic principles of equilibrium, geometric compatibility, and material behavior. Stress and its relation to force and moment; strain and its relation to displacement; linear elasticity with thermal expansion. Failure modes. Application to simple engineering structures such as rods, shafts, beams, and trusses. Application to biomechanics of natural materials and structures.


2.002 Mechanics and Materials II
Prereq: 2.001; 3.091, 5.111, or 5.112
U (Fall, Spring)
3-3-6

Introduces mechanical behavior of engineering materials, and the use of materials in mechanical design. Emphasizes the fundamentals of mechanical behavior of materials, as well as design with materials. Major topics: elasticity, plasticity, limit analysis, fatigue, fracture, and creep. Materials selection. Laboratory experiments involving projects related to materials in mechanical design.

L. Anand, M. C. Boyce, K. Hamad-Schifferli, D. M. Parks

2.003 Dynamics and Control I
(Same subject as 1.053)
Prereq: 8.01, 18.03
U (Fall, Spring)
4-1-7 REST


N. G. Hadjiconstantinou, G. Haller, N. C. Makris, N. M. Patrikalakis, T. Peacock

2.004 Dynamics and Control II
Prereq: 2.003, 8.02
U (Fall, Spring)
4-2-6

Modeling, analysis, and control of dynamic systems. System modeling: lumped parameter models of mechanical, electrical, and electromechanical systems; interconnection laws; actuators and sensors. Linear systems theory: linear algebra; Laplace transform; transfer functions, time response and frequency response, poles and zeros; block diagrams; solutions via analytical and numerical techniques; stability. Introduction to feedback control: closed-loop response; PID compensation; steady-state characteristics, root-locus design concepts, frequency-domain design concepts. Laboratory experiments and control design projects.


2.005 Thermal-Fluids Engineering I
Prereq: 8.02, 18.02, 18.03
U (Fall, Spring)
5-0-7 REST


J. G. Brisson, E. G. Cravalho, A. F. Ghoniem, G. H. McKinley

2.007 Design and Manufacturing I
Prereq: 2.001, 2.670
U (Spring)
3-4-5

Develops students’ competence and self-confidence as design engineers. Emphasis on the creative design process bolstered by application of physical laws, and learning to complete projects on schedule and within budget. Synthesis, analysis, design robustness and manufacturability are emphasized. Subject relies on active learning via a major design-and-build project. Lecture topics include idea generation, estimation, concept selection, visual thinking and communication, kinematics of mechanisms, machine elements, design for manufacturing, basic electronics, and professional responsibilities and ethics. A required online evaluation is given at the beginning and the end of the course so students can assess their design knowledge.
A. H. Slocum

2.008 Design and Manufacturing II
Prereq: 2.001; 2.005; 2.007 or 2.017
U (Fall, Spring)
3-5-4 1/2 Institute LAB

Integration of design, engineering, and management disciplines and practices for analysis and design of manufacturing enterprises. Emphasis is on the physics and stochastic nature of manufacturing processes and systems, and their effects on quality, rate, cost, and flexibility. Topics include process physics and control, design for manufacturing, and manufacturing systems. Group project requires design and fabrication of parts using mass-production and assembly methods to produce a product in quantity. Six units may be applied to the General Institute Lab Requirement.

2.009 The Product Engineering Process
Prereq: 2.001, 2.003, 2.005, 2.670
U (Fall)
3-3-6

Students develop an understanding of product development phases and experience working in teams to design and construct high-quality product prototypes. Design process learned is placed into a broader development context. Primary goals are to improve ability to reason about design alternatives and apply modeling techniques appropriate for different development phases; understand how to gather and process customer information and transform it into engineering specifications; and use teamwork to resolve the challenges in designing and building a substantive product prototype. Instruction and practice in oral communication provided. Senior-standing or permission of instructor.
D. R. Wallace

2.012J Mechanics of Structures
(Same subject as 1.052J)
Prereq: 2.001 or 1.050
U (Spring)
4-1-7

Mechanics of materials, elastic and plastic behavior, fatigue, fracture. Analytical and computational techniques to assess response of complex structures under static loads (beams, shafts, trusses, frames, cables). Energy methods to explain the concepts of equilibrium, stability, principle of virtual work, and to develop approximate methods for deflections and buckling loads. Examples using Matlab and PC versions of commercial finite element codes. Mechanical, ocean and civil engineering applications.
T. Wierzbicki, N. M. Patrikalakis, H. Schmidt

2.016 Hydrodynamics
Prereq: 8.02, 18.03
U (Fall)
4-2-6

Principles of conservation of mass, momentum and energy in fluid mechanics. Basic geophysical fluid mechanics, including the effects of salinity, temperature, and density; heat balance in the ocean; large scale flows. Hydrostatics. Linear free surface waves, wave forces on floating and submerged structures. Added mass, lift and drag forces. Introduction to ocean acoustics; sound propagation and refraction. Sonar equation. Laboratory sessions in wave propagation, lift and drag forces on submerged bodies, and sound propagation.
A. H. Techet

2.017J Design of Systems Operating in Random Environments
(Same subject as 1.015J)
Prereq: 2.003; 2.005 or 2.016; 2.671
U (Spring)
3-4-5 1/2 Institute LAB

Design, construction and testing of a field robotic system, involving team projects with each student responsible for a specific subsystem. Projects focus on electronics, instrumentation, and machine elements. Design for operation in uncertain conditions is considered, with ocean waves and marine structures as a central theme. Use basic statistics, linear systems, Fourier transforms, random processes, spectra and extreme events with applications in design. Lectures on ethics in engineering practice included. Enrollment may be limited due to laboratory capacity. Offered in Spring 2008 to accommodate current majors; after that it will be offered every fall term starting with Fall 2008.
M. S. Triantafyllou, F. S. Hover

2.019 Design of Ocean Systems
Prereq: 2.001; 2.003; 2.005 or 2.016; 2.670
U (Spring)
3-3-6

Complete cycle of designing an ocean system using computational design tools for the conceptual and preliminary design stages; team projects assigned, with each student responsible for a specific subsystem. Lectures on design cover hydrodynamics, structures, power and thermal aspects of ocean vehicles, environment, materials, and construction for ocean use as well as generation and evaluation of design alternatives. Focus on innovative design concepts chosen from high-speed ships, submersibles, autonomous vehicles, and floating and submerged deep-water offshore platforms. Lectures on ethics in engineering practice included. Instruction and practice in oral and written communication provided. Senior standing or permission of instructor.
C. Chryssostomidis, N. M. Patrikalakis
DYNAMICS AND ACOUSTICS

2.032 Dynamics
Prereq: 2.003J
G (Fall)
3-0-9 H-LEVEL Grad Credit

T. R. Akylas, C. C. Mei, R. R. Rosales

2.034J Nonlinear Dynamics and Waves
(Same subject as 1.685J, 18.377J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

A unified treatment of nonlinear oscillations and wave phenomena with applications to mechanical, optical, geophysical, fluid, electrical and flow-structure interaction problems. Nonlinear free and forced vibrations; nonlinear resonances; self-excited oscillations; lock-in phenomena; Nonlinear dispersive and nondispersive waves; resonant wave interactions; propagation of wave pulses and nonlinear Schrodinger equation. Nonlinear long waves and breaking; theory of characteristics; the Korteweg-de Vries equation; solitons and solitary wave interactions. Stability of shear flows. Some topics and applications may vary from year to year.
T. R. Akylas, C. C. Mei, R. R. Rosales

2.035 Special Topics in Mathematics with Applications
Prereq: 8.02, 18.03 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-3 H-LEVEL Grad Credit

Introduction to a selection of mathematical topics that are not covered in traditional mechanical engineering curricula, such as differential geometry, integral geometry, discrete computational geometry, graph theory, optimization techniques, calculus of variations and linear algebra. Emphasis on basic ideas and on applications in mechanical engineering. Selection will change every year.
R. C. Abeyaratne, S. E. Sarma

2.036J Nonlinear Dynamics and Chaos
(Same subject as 18.385J)
Prereq: 18.03 or 18.034
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 18.385J.
G. Haller, R. R. Rosales

2.037J Advanced Nonlinear Dynamics and Chaos
(Same subject as 18.386J)
Prereq: 18.385/2.036 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 18.386J.
G. Haller, R. R. Rosales

2.050J Nonlinear Dynamics I: Chaos (New)
(Same subject as 12.006J, 18.353J)
Prereq: 18.03, 8.02
U (Fall)
3-0-9
See description under subject 12.006J.
T. Peacock

2.06J Mechanical Vibration
(Same subject as 1.058J)
Prereq: 2.003J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
4-0-8

Concepts of mechanical vibration, including free and forced vibration of single- and multi-degree of freedom systems. Modal analysis and matrix formulation of vibration problems. Approximate solution techniques. Vibration and modal analysis of continuous systems: beams, rods, and strings. Introduction to the response of linear systems to random excitation. Numerous examples and applications of vibration measurement and analysis, including vibration isolation and dynamic absorbers, ships, offshore structures, engines, and rotating machinery.
E. A. Kausel, J. K. Vandiver

2.060J Advanced Structural Dynamics
(Same subject as 1.581J, 16.221J)
Prereq: 18.03, 1.573J
G (Fall)
3-1-8 H-LEVEL Grad Credit

See description under subject 1.581J.
E. Kausel, J. K. Vandiver

2.062J Wave Propagation
(Same subject as 1.138J, 18.376J)
Prereq: 2.003J, 18.075
G (Spring)
3-0-9 H-LEVEL Grad Credit

T. R. Akylas, C. C. Mei, R. R. Rosales

2.064J Surface Wave Dynamics
(Same subject as 1.691J)
Prereq: 1.060, 2.25 or 13.012; 1.131 or 18.075; or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

2.065 Acoustics and Sensing
(Subject meets with 2.066)
Prereq: 2.003J, 6.003, 8.03, or 16.03
U (Spring)
3-0-9

2.066 Acoustics and Sensing
(Subject meets with 2.065)
Prereq: 2.003J, 6.003, 8.03, 16.03, or permission of instructor
G (Spring)
3-0-9 H-Level Grad Credit

Introduces the fundamental concepts of acoustics and sensing with waves. Provides a unified theoretical approach to the physics of image formation through scattering and wave propagation in sensing. The linear and nonlinear acoustic wave equation, sources of sound. Reflection, refraction, transmission and absorption. Bearing and range estimation by sensor array processing, beamforming, matched filtering, and focusing. Diffraction, bandwidth, ambient noise and reverberation limitations. Scattering from objects, surfaces and volumes by Green’s Theorem. Forward scatter, shadows, Babinet’s principle, extinction and attenuation. Ray tracing and waveguides in remote sensing. Applications to acoustic, radar, seismic, thermal and optical
SOLID MECHANICS AND MATERIALS

2.071 Mechanics of Solid Materials
Prereq: 2.002
G (Spring)
4-0-8 H-LEVEL Grad Credit

Fundamentals of solid mechanics applied to the mechanical behavior of engineering materials. Kinematics of deformation, stress, and balance principles. Isotropic linear elasticity and isotropic linear thermal elasticity. Variational and energy methods. Linear viscoelasticity. Small-strain elastic-plastic deformation. Mechanics of large deformation; nonlinear hyperelastic material behavior. Foundations and methods of deformable-solid mechanics, including relevant applications. Provides base for further study and specialization within solid mechanics, including continuum mechanics, computational mechanics (e.g., finite-element methods), plasticity, fracture mechanics, structural mechanics, and nonlinear behavior of materials.
L. Anand, M. C. Boyce, D. M. Parks, S. Socrate

2.072 Mechanics of Continuous Media
Prereq: 2.071
G (Fall)
3-0-9 H-LEVEL Grad Credit

R. C. Abeyaratne, L. Anand

2.073 Solid Mechanics: Plasticity and Inelastic Deformation
Prereq: 2.071
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Physical basis of plastic/inelastic deformation of solids; metals, polymers, granular/rock-like materials. Continuum constitutive models for small and large deformation of elastic-(visco)plastic solids. Analytical and numerical solution of selected boundary value problems. Applications to deformation processing of metals.
L. Anand, M. C. Boyce, D. M. Parks

2.074 Solid Mechanics: Elasticity
Prereq: 2.002, 18.03
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

R. C. Abeyaratne, D. M. Parks, S. Socrate, J. H. Williams, Jr.

2.075 Advanced Mechanical Behavior of Materials
Prereq: 2.071, 3.091
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Fundamentals of the mechanical behavior of engineering materials and their uses in structural and design-related applications is presented, starting from a mechanistic point of view to arrive at phenomenological forms of constitutive behavior for deformation and fracture. Problems involving elasticity, plasticity, creep, visco-elasticity, rubber elasticity and monotonic and cyclic fracture discussed.
M. C. Boyce, D. M. Parks

2.080j Structural Mechanics
(Same subject as 1.573j)
Prereq: 2.002 or 2.012
G (Fall)
4-0-8 H-LEVEL Grad Credit

Fundamental concepts of structural mechanics with applications to marine, civil, and mechanical structures. Residual stresses. Thermal effects. Analysis of beams, columns, tensioned beams, trusses, frames, arches, cables, and shafts of general shape and material, including composites. Elastic buckling of columns. Exact and approximate methods, energy methods, principle of virtual work, introduction to computational structural mechanics. Examples from civil, mechanical, offshore, and ship structures.
T. Wierzbicki, J. J. Connor, Jr.

2.081j Plates and Shells
(Same subject as 16.230)
Prereq: 2.074, 2.080j, or 16.21
G (Spring)
3-0-3 H-LEVEL Grad Credit

T. Wierzbicki

2.082 Ship Structural Analysis and Design
Prereq: 2.081j, 2.701
G (Spring)
3-0-3 H-LEVEL Grad Credit

Design application of analysis developed in 2.081j. Ship longitudinal strength and hull primary stresses. Ship structural design concepts. Design limit states including plate bending, column and panel buckling, panel ultimate strength, and plastic analysis. Matrix stiffness, and introduction to finite element analysis. Computer projects on the structural design of a midship module. Taught during second half of term.
D. V. Burke, T. Wierzbicki, C. Chryssostomidis

2.084j Structural Mechanics in Nuclear Power Technology
(Same subject as 1.56j, 22.314j)
Prereq: 2.001 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 22.314j.
M. S. Kazimi, O. Buyukozturk

2.085 Structural Impact
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
2-0-4 H-LEVEL Grad Credit

half of the term. Students can take 2.707 in first half of the term.
T. Wierzbicki

COMPUTATIONAL ENGINEERING

2.088 Introduction to Modeling and Simulation
Engineering School-Wide Elective Subject.
(Offered under: 1.021, 2.088, 3.021, 10.333, 18.361, 22.00, HST.558)
Prereq: 18.03
U (Spring)
3-0-9 REST
See description under subject 22.00.
M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Radovitzky, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

2.089j Computational Geometry
(Same subject as 1.128J, 16.940J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
N. M. Patrikalakis, D. C. Gossard

2.092 Computer Methods in Dynamics
(Subject meets with 2.093)
Prereq: 2.001; 2.003
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9
2.093 Computer Methods in Dynamics
(Subject meets with 2.092)
Prereq: 2.001, 2.003
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
K. J. Bathe

2.094 Finite Element Analysis of Solids and Fluids
Prereq: 2.001
G (Spring)
3-0-9 H-LEVEL Grad Credit
Basic principles of continuum mechanics and finite element methods, modern application to solution of practical problems in solid, structural, and fluid mechanics, heat and mass transfer, other field problems. Kinematics of deformation, strain and stress measures, constitutive relations, conservation laws, virtual work, and variational principles. Discretization of governing equations using finite element methods. Solution of central problems using an existing general purpose finite element analysis program.
K. J. Bathe

2.095 Molecular Modeling and Simulation for Mechanics
Prereq: 2.002, 2.006, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
N. G. Hadjiconstantinou

2.096j Introduction to Numerical Simulation
(Same subject as 6.336J, 16.910J)
Prereq: 18.03 or 18.06
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 6.336J.

2.097j Numerical Methods for Partial Differential Equations
(Same subject as 16.339J, 16.920J)
Prereq: 18.03 or 18.06
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 16.920J.
D. L. Darmofal, A. T. Patera, J. K. White

2.099j Computational Mechanics of Materials
(Same subject as 16.225J)
Prereq: Permission of instructor, programming in either C++, C, or Fortran
G (Spring)
3-3-6 H-LEVEL Grad Credit
See description under subject 16.225J.
R. Radovitzky, L. J. Noels

SYSTEM DYNAMICS AND CONTROL

2.110j Information, Entropy and Computation
(Same subject as 6.050J)
Prereq: 8.01, 8.012, 8.01L or 8.01T
U (Spring)
4-0-5
See description under subject 6.050J.
P. Penfield, Jr., S. Lloyd

2.111j Quantum Computation
(Same subject as 18.435J, ESD.79J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 18.435J.
E. Farhi, S. Lloyd, P. Shor
2.12 Introduction to Robotics
Prereq: 2.004
U (Fall)
3-2-7
Overview of robot mechanisms, dynamics, and intelligent controls. Planar and spatial kinematics, motion planning; mechanism design for manipulators and mobile robots, multirigid-body dynamics, 3-D graphic simulation; control design, actuators, sensors; wireless networking, task modeling, human-machine interface, and imbedded software. Weekly laboratories for experience with servo drives, real-time control, and embedded software. Group term project requires design and fabrication of robotic systems.

H. Asada, J. J. Leonard

2.131 Advanced Instrumentation and Measurement
Prereq: Permission of instructor
G (Spring)
3-6-3
Provides training in advanced instrumentation and measurement techniques. Topics include system level design, fabrication and evaluation with emphasis on systems involving concepts and technology from mechanics, optics, electronics, chemistry and biology. Simulation, modeling and design software. Use of a wide range of instruments/techniques (e.g., scanning electron microscope, dynamic signal/system analyzer, impedance analyzer, laser interferometer) and fabrication/machining methods (e.g., laser micro-machining, stereo lithography, computer controlled turning and machining centers).

I. W. Hunter

2.14 Analysis and Design of Feedback Control Systems
(Subject meets with 2.140)
Prereq: 2.004
U (Spring)
3-2-7
2.140 Analysis and Design of Feedback Control Systems
(Subject meets with 2.14)
Prereq: 2.004 or permission of instructor
G (Spring)
3-2-7 H-LEVEL Grad Credit

Develops the fundamentals of feedback control using linear transfer function system models. Analysis in time and frequency domains. Design in the s-plane (root locus) and in the frequency domain (loop shaping). Describing functions for stability of certain nonlinear systems. Extension to state variable systems and multivariable control with observers. Discrete and Digital hybrid systems and use of z-plane design. Extended design case studies and capstone group projects. Graduate students are expected to complete additional assignments.

D. Rowell, D. L. Trumper

2.141 Modeling and Simulation of Dynamic Systems
Prereq: 2.151
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Modeling multidomain engineering systems at a level of detail suitable for design and control system implementation. Network representation, state-space models; multiport energy storage and dissipation, Legendre transforms; nonlinear mechanics, transformation theory, Lagrangian and Hamiltonian forms; control-relevant properties. Application examples may include electro-mechanical transducers, mechanisms, electronics, fluid and thermal systems, compressible flow, chemical processes, diffusion, and wave transmission.

N. Hogan

2.151 Advanced System Dynamics and Control
Prereq: 2.004, 18.06
G (Fall)
4-0-8 H-LEVEL Grad Credit

Analytical and graphical descriptions of state-determined dynamic physical systems; time and frequency domain representations; system characteristics—controllability, observability, stability, linear and nonlinear system responses. Modification of system characteristics using feedback. State observers, Kalman filters. Modeling/performance trade-offs in control system design. Emphasis on application of techniques to physical systems.

K. YouCEF-Toumi, N. Hogan, D. Rowell

2.152 Nonlinear Control System Design
Prereq: 2.151, 6.241, 16.31, or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit


J.-J. E. Slotine

2.154 Maneuvering and Control of Surface and Underwater Vehicles
Prereq: 2.22
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit


M. S. Triantafyllou

2.160 Identification, Estimation, and Learning
Prereq: 2.151
G (Spring)
3-0-9 H-LEVEL Grad Credit

Provides a broad theoretical basis for system identification, estimation, and learning. Least squares estimation and its convergence properties, Kalman filter and extended Kalman filter, noise dynamics and system representation, function approximation theory, neural nets, radial basis functions, wavelets, Volterra expansions, informative data sets, persistent excitation, asymptotic variance, central limit theorems, model structure selection, system order estimate, maximum likelihood, unbiased estimates, Cramer-Rao lower bound, Kullback-Leibler information distance, Akaike’s information criterion, experiment design, and model validation.

H. Asada, J.-J. E. Slotine, S. Lloyd

2.161 Signal Processing: Continuous and Discrete
Prereq: Knowledge of system dynamics
G (Fall)
3-0-9 H-LEVEL Grad Credit

Provides a solid theoretical foundation for the analysis and processing of experimental data, and real-time experimental control methods. Includes spectral analysis, filter design, system identification, simulation in continuous and discrete-time domains. Emphasis on practical problems with laboratory exercises.

D. Rowell
2.165 Robotics
Prereq: 2.151 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

J. J. Slotine, H. Asada

2.166 Probabilistic Techniques for Mobile Robotics
Prereq: 2.165; 6.041 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit

Theory and application of probabilistic techniques for autonomous mobile robotics. Topics include probabilistic state estimation and decision making for mobile robots; stochastic representations of the environment; dynamic models and sensor models for mobile robots; algorithms for mapping and localization; planning and control in the presence of uncertainty; cooperative operation of multiple mobile robots; mobile sensor networks; application to autonomous marine (underwater and floating), ground, and air vehicles.
J. J. Leonard

2.167 Hands-On Marine Robotics (New)
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Direct experience in developing marine robotic systems, from conceptualization and design through manufacture and testing. The class consists of a weekly seminar with readings and discussions, and significant outside work on student projects, culminating in a written report each term. Seminar topics include tools for unmanned marine work and their history, analysis of mission requirements, conceptual design and modeling of systems, experiments and proofs of concept, and project pacing and time management. A total of up to 12 hours credit may be taken over one or two terms; seminar topics repeat yearly.
F. S. Hover

2.168 Analysis, Design, and Control of Automated Equipment
Prereq: 2.14, 2.151
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Emphasizes a systems approach to equipment selection and/or design. Provides exposure to selected industrial automation practices and develops the ability to select appropriate automation methods. Fundamental building blocks are: system kinematics and dynamics, modeling, measurement and actuation, uncertainty, control-system theory. System performance limitation due to hardware/software. Use of feedback control system to meet equipment performance specifications. Use of case studies from industrial applications.
K. Youcef-Toumi, D. E. Hardt

2.171 Analysis and Design of Digital Control Systems
Prereq: 2.14, 2.151, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-3-6 H-LEVEL Grad Credit

A comprehensive introduction to digital control system design, reinforced with hands-on laboratory experiences. Major topics include discrete-time system theory and analytical tools; design of digital control systems via approximation from continuous time; direct discrete-time design; loop-shaping design for performance and robustness; state-space design; observers and state-feedback; quantization and other nonlinear effects; implementation issues. Laboratory experiences and design projects connect theory with practice.
D. L. Trumper, D. Rowell

2.183 Biomechanics and Neural Control of Movement
Prereq: 2.004 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Normal and pathological sensory-motor behavior of biological systems emerges from a complex interplay of biomechanical and neural factors. Experimentally supported theories of biological motor control, emphasizing manipulation and tool use, are critiqued and compared with robotic approaches. Topics include hierarchical organization, intermittency, optimization theories, kinematic redundancy, neuromuscular dynamics and segmental feedback, “equilibrium-point” theories, instabilities in contact tasks, co-contraction strategies, and impedance control.
N. Hogan

FLUID MECHANICS AND COMBUSTION

2.20 Marine Hydrodynamics
Prereq: 2.006, 2.016, or 1.060
G (Fall)
4-1-7 H-LEVEL Grad Credit

D. K. P. Yue

2.21 Fluid Dynamics
(Same subject as 1.63J)
Prereq: 18.085 or 1.131J, 2.25 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit

See description under subject 1.63J.
C. C. Mei, G. H. McKinley, T. R. Akylas, R. Stocker

2.22 Design Principles for Ocean Vehicles
Prereq: 2.20
G (Spring)
3-3-6 H-LEVEL Grad Credit

Design tools for analysis of linear systems and random processes related to ocean vehicles; description of ocean environment including random waves, ocean wave spectra and their selection; short and long term wave statistics; and ocean currents. Advanced hydrodynamics for design of ocean vehicles and offshore structures including wave forces on towed and moored structures; inertia vs. drag dominated flows; vortex induced vibrations of offshore structures; ship seakeeping and sensitivity of seakeeping performance. Design exercises in application of principles. Several laboratory exercises emphasizing modern measurement techniques, model testing, and flow diagnostic tools.
M. S. Triantafyllou
2.23 Hydrofoils and Propellers
Prereq: 2.20, 18.085
G (Spring)
4-0-8 H-LEVEL Grad Credit
Develops theory and design of hydrofoil sections; lifting and thickness problems for subcavitating sections and unsteady flow problems. Computer-aided design of low drag, cavitation free sections. Covers lifting line and lifting surface theory with applications to hydrofoil craft, rudder, control surface, propeller and wind turbine rotor design. Topics include propeller lifting line and lifting surface theory; computer-aided design of wake adapted propellers, steady and unsteady propeller thrust and torque; performance analysis and design of wind turbine rotors in steady and stochastic wind. Develops numerical principles of vortex lattice and lifting surface panel methods. Projects illustrate the development of computational methods for lifting, propeller and wind turbine flows; use of state-of-the-art simulation methods illustrates their use to lifting, propulsion and wind turbine applications.

P. D. Sclavounos

2.24 Ocean Wave Interaction with Ships and Offshore Energy Systems
Prereq: 2.20, 18.085
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8 H-LEVEL Grad Credit
Reviews surface wave theory, conservation laws and boundary conditions; discusses properties of regular surface waves and stochastic ocean waves. Ship wave resistance theory, Kelvin wake physics, wave-body interaction theory and ship seakeeping in regular and random waves. Introduces methods of ship motion control in a deterministic and random waves. Discusses offshore bottom mounted and floating energy systems and their interaction with ambient waves, current and wind; discusses oil and gas platforms, Liquefied Natural Gas (LNG) vessels, floating wind turbines and wave power absorbers. Develops numerical principles of panel methods and their use for non-lifting potential flows and wave-body interactions. Projects illustrate use of panel and state-of-the-art simulation methods to the seakeeping of ships and offshore energy systems.

P. D. Sclavounos

2.25 Advanced Fluid Mechanics
Prereq: 2.006; 18.075 or 18.085
G (Fall)
4-0-8 H-LEVEL Grad Credit

2.26 Compressible Fluid Dynamics
Prereq: 2.006
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
2-0-4 H-LEVEL Grad Credit
Fundamental concepts and results for the compressible flow of gases. Topics include thermodynamics, appropriate conservation laws; propagation of disturbances; isentropic flows; normal shock wave relations, oblique shock waves, weak and strong shocks, and shock wave structure; compressible flows in ducts with area changes, friction, or heat addition; heat transfer to high speed flows; unsteady compressible flows, Riemann invariants, and piston and shock tube problems; steady 2-D supersonic flow, Prandtl-Meyer function. Emphasis on thermodynamic processes, physical understanding of the phenomena and basic analytical techniques.
J. H. Lienhard

2.27 Turbulent and Separated Flows
Prereq: 2.20 or 2.25; 18.075
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Governing equations, and statistical and dynamical theories of turbulence. Isotropic homogeneous turbulence, near wall turbulence, effects of free surface and surfactants and moving body boundary. Direct numerical simulations, large eddy simulations and sub-grid scale modeling, Reynolds-Average Navier-Stokes (RANS) equations and RANS turbulence models. Flow instability and transitions, almost parallel flows and inviscid and viscous instabilities. Laminar and turbulent separation, expansion flows, separated flows past bluff and streamlined bodies; flow induced vibrations.
D. K. P. Yue

2.28 Fundamentals and Applications of Combustion
Prereq: 2.006
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
A. F. Ghoniem

2.29 Numerical Fluid Mechanics for Engineers
Prereq: 2.006, 2.016, 2.20, or 2.25; 18.075
G (Spring)
4-0-8 H-LEVEL Grad Credit
P. F. J. Lermusiaux

2.341] Macromolecular Hydrodynamics
(Subject meets with 10.531)
Prereq: 2.25, 10.301, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit
See description under subject 10.531.
R. C. Armstrong, G. H. McKinley

MEMS AND NANO TECHNOLOGY

2.37 Molecular Mechanics
(Subject meets with 2.370)
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
N. G. Hadjiconstantinou

2.370 Molecular Mechanics
(Subject meets with 2.37)
Prereq: 2.001; 3.091, 5.111, or 5.112
U (Fall)
4-0-8
Introduction to the fundamentals of molecular modeling in engineering, with emphasis on mechanical engineering applications. Statistical mechanics and its connection to engineering thermodynamics. Molecular origin of macro-
scopric descriptions and constitutive relations for equilibrium and non-equilibrium behavior. Limitations of macroscopic descriptions. Discussion of molecular approaches to modern nanoscale engineering problems. Introduction to molecular simulation. Graduate students are required to complete additional assignments with stronger analytical content.

N. G. Hadjiconstantinou

2.371 Microscale Fluid Mechanics
Prereq: 2.005; 8.02
U (Spring)
3-0-9
Introduction to the manipulation of liquids in microscale conduits. Emphasizes both pressure-based and electrochemical driving forces, including electro-osmosis and dielectrophoresis. Major topics include viscosity, diffusion, mixing, electrokinetics and the Debye layer, pumps, fluid polarization, and particle behavior in pressure-based and charged environments.

T. Thorsen

2.372J) Design and Fabrication of MEMS
(Same subject as 6.777J)
Prereq: 6.003 or 2.004, 8.02, or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
See description under subject 6.777J.

C. Livermore, M. A. Schmidt, J. Voldman

2.373J) Materials and Processes for Microelectromechanical Devices and Systems
(Same subject as 3.48J, 6.778J, 10.584J, 16.288J)
Prereq: 6.152J/3.155J; permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 3.48J.

L. Anand, K. F. Jensen, M. A. Schmidt, C. V. Thompson, B. L. Wardle

2.391J) Submicrometer and Nanometer Technology
(Same subject as 6.781J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 6.781J.

H. I. Smith, G. Barbastathis, K. Berggren

THERMODYNAMICS

2.41 Advanced Thermal Fluids Engineering
Prereq: 2.006
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8
Examines current and future energy conversion systems. Introduction to thermochemistry and thermal radiation heat transfer. Introduction to the design of turbomachinery and the design of thermal-fluids systems. Analysis of various energy conversion systems including Rankine, Brayton, Otto, and Diesel. Special attention to combined cycle plants and fuel cells. Introduction to refrigeration plants. Applications include stationary plants and mobile plants. Consideration of pollution, environmental, and policy issues.

E. G. Cravalho

2.42 General Thermodynamics
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
General foundations of thermodynamics from an entropy point of view, entropy generation and transfer in complex systems. Definitions of work, energy, stable equilibrium, available energy, entropy, thermodynamic potential, and interactions other than work (nonwork, heat, mass transfer). Applications to properties of materials, bulk flow, energy conversion, chemical equilibrium, combustion, and industrial manufacturing.

E. G. Cravalho

HEAT AND MASS TRANSFER

2.51 Intermediate Heat and Mass Transfer
Prereq: 2.006 or permission of instructor
U (Fall)
3-0-9
Analysis, modeling, and design of heat and mass transfer processes with application to common technologies. Unsteady heat conduction in one or more dimensions, steady conduction in multidimensional configurations, numerical simulation; forced convection in laminar and turbulent flows; natural convection in internal and external configurations; phase change heat transfer; thermal radiation, black bodies, grey radiation networks, spectral and solar radiation; mass transfer at low rates, evaporation.

J. H. Lienhard, B. Mikic

2.52 Modeling and Approximation of Thermal Processes
Prereq: 2.51
G (Fall)
3-0-3 H-LEVEL Grad Credit
Focuses on teaching students how to model thermal transport processes in typical engineering systems such as those found in manufacturing, machinery, and energy technologies. Subject is divided into successive modules that cover basic modeling tactics for particular modes of transport, including steady and unsteady heat conduction, convection, multiphase flow processes, and thermal radiation. Subject includes a creative design project executed by the students. Meets first half of term.

L. R. Glicksman, J. H. Lienhard

2.55 Advanced Heat and Mass Transfer
Prereq: 2.51
G (Spring)
3-0-9 H-LEVEL Grad Credit
Advanced treatment of fundamental aspects of heat and mass transport. Topics covered include: diffusion kinetics, conservation laws, laminar and turbulent convection, mass transfer including phase change or heterogeneous reactions, and basic thermal radiation. Problems and examples include theory and applications drawn from a spectrum of engineering design and manufacturing problems.

B. Mikic, J. H. Lienhard

2.56 Conduction and Change of Phase Heat Transfer
Prereq: 2.51, 18.075
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

B. Mikic

2.57 Nano-to-Macro Transport Processes
Prereq: 2.005 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Parallel treatments of photons, electrons, phonons, and molecules as energy carriers, aiming
at a fundamental understanding of descriptive tools for energy and heat transport processes from nanoscale to macroscale. Topics include the energy levels, the statistical behavior and internal energy, energy transport in the forms of waves and particles, scattering and heat generation processes, Boltzmann equation and derivation of classical laws, deviation from classical laws at nanoscale and their appropriate descriptions, with applications in nanotechnology and microtechnology.

G. Chen

2.58j Radiative Transfer
(Same subject as 10.74j)
Prereq: 2.51, 10.302, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Principles of thermal radiation and their application to engineering heat and photon transfer problems. Quantum and classical models of radiative properties of materials, electromagnetic wave theory for thermal radiation, radiative transfer in absorbing, emitting, and scattering media, and coherent laser radiation. Applications cover laser-material interactions, imaging, infrared instrumentation, global warming, semiconductor manufacturing, combustion, furnaces, and high temperature processing.

G. Chen

2.59j Thermal Hydraulics in Power Technology
(Same subject as 10.536j, 22.313j)
Prereq: 2.006, 10.302, 22.312, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 22.313j.
J. Buongiorno

ENERGY AND POWER SYSTEMS

2.60 Fundamentals of Advanced Energy Conversion
(Subject meets with 2.62j, 10.392j, 22.40j)
Prereq: 2.006 or permission of instructor
U (Spring)
4-0-8

Fundamentals of thermodynamics, chemistry, and transport applied to energy systems. Analysis of energy conversion and storage in thermal, mechanical, chemical, and electrochemical processes in power and transportation systems, with emphasis on efficiency, performance and environmental impact. Applications to fuel reforming, hydrogen, fuel cells and batteries, combustion, catalysis, combined and hybrid power cycles using fossil, nuclear and renewable resources. CO2 separation and capture. Biomass energy. Graduate students are expected to complete additional assignments.

A. F. Ghoniem, M. Kazimi, Y. Shao-Horn, J. Tester

2.61 Internal Combustion Engines
Prereq: 2.006
G (Spring)
3-1-8 H-LEVEL Grad Credit

Fundamentals of how the design and operation of internal combustion engines affect their performance, efficiency, fuel requirements, and environmental impact. Study of fluid flow, thermodynamics, combustion, heat transfer and friction phenomena, and fuel properties, relevant to engine power, efficiency, and emissions. Examination of design features and operating characteristics of different types of internal combustion engines: spark-ignition, diesel, stratified-charge, and mixed-cycle engines. Engine Laboratory project. For graduate and senior undergraduate students.

W. K. Cheng

2.611 Marine Power and Propulsion
(Subject meets with 2.612)
Prereq: 2.005
G (Fall)
4-0-8 H-LEVEL Grad Credit

2.612 Marine Power and Propulsion
(Subject meets with 2.611)
Prereq: 2.005
U (Fall)
4-0-8

Selection and evaluation of commercial and naval ship power and propulsion systems. Analysis of propulsion, prime mover thermodynamic cycles, propeller-engine matching. Propeller selection, waterjet analysis, review of alternative propulsors; thermodynamic analyses of Rankine, Brayton, Diesel, and Combined cycles, reduction gears and integrated electric drive. Battery operated vehicles, fuel cells. Term project requires analysis of alternatives in propulsion plant design for given physical, performance, and economic constraints. Graduate students complete different assignments and exams.

A. F. Ghoniem, M. S. Triantafyllou, D. V. Burke

2.62j Fundamentals of Advanced Energy Conversion
(Same subject as 10.392j, 22.40j)
(Subject meets with 2.60)
Prereq: 2.006 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit

Fundamentals of thermodynamics, chemistry, and transport applied to energy systems. Analysis of energy conversion and storage in thermal, mechanical, chemical, and electrochemical processes in power and transportation systems, with emphasis on efficiency, performance and environmental impact. Applications to fuel reforming, hydrogen, fuel cells and batteries, combustion, catalysis, combined and hybrid power cycles using fossil, nuclear and renewable resources. CO2 separation and capture. Biomass energy.

A. F. Ghoniem, M. Kazimi, Y. Shao-Horn, J. Tester

2.625 Electrochemical Systems: Fundamentals, Materials and Applications
Prereq: 3.53, 2.005, 3.046, or permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit

Fundamental concepts, tools, and applications in electrochemical science and engineering. Introduces thermodynamics, kinetics and transport of electrochemical reactions. Describes how materials structure and properties affect electrochemical behavior of particular applications, for instance in lithium rechargeable batteries, electrochemical capacitors, fuel cells, photo electrochemical cells, and electrolytic cells. Discusses state-of-the-art electrochemical energy technologies for portable electronic devices, hybrid and plug-in vehicles, electrical vehicles. Theoretical and experimental exploration of electrochemical measurement techniques in cell testing, and in bulk and interfacial transport measurements (electronic and ionic resistivity and charge transfer cross the electrode-electrolyte interface).

Y. Shao-Horn

2.63 Applications of Technology in Energy and the Environment
Engineering School-Wide Elective Subject.
(Offered under: 1.149, 2.63, 5.00, 10.579, 22.813, ESD.174)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 22.813.
J. Deutch, R. Lester
2.64 Superconducting Magnets
Prereq: 2.51
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Focuses on one important engineering application of superconductors—generation of large-scale and intense magnetic fields. Review of electromagnetic theory; detailed treatment of magnet design and operational issues, including “usable” superconductors, field and stress analyses, magnet instabilities, ac losses and mechanical disturbances, quench and protection, experimental techniques, and cryogenics. New high-temperature superconductors for magnets—design and operational issues at high temperatures.
Y. Iwasa

2.65J Sustainable Energy
(Same subject as 1.818J, 10.391J, 11.371J, 22.811J, ESD.166J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject 10.391J.
M. W. Golay, J. W. Tester, J. P. Freidberg

2.66J Fundamentals of Energy in Buildings
(Same subject as 1.044J, 4.42J)
Prereq: 8.01, 18.02
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-2-7 REST
See description under subject 4.42J.
L. R. Glicksman

2.661J Architectural Thermal and Fluid Dynamics
(Same subject as 4.423J)
Prereq: 2.005, 4.42, or 2.25
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-2-7 H-LEVEL Grad Credit
See description under subject 4.423J.
L. Glicksman, L. K. Norford

2.67J Analysis and Design of Heating, Ventilating, and Air Conditioning Systems
(Same subject as 4.427J)
Prereq: 2.006 or 4.42
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 4.427J.
L. K. Norford, L. Glicksman

EXPERIMENTAL ENGINEERING

2.670 Mechanical Engineering Tools
Prereq: —
U (IAF)
1-3-2 [P/D/F]
Introduces the fundamentals of machine tool and computer tool use. Students work with a variety of machine tools including the bandsaw, milling machine, and lathe. Instruction given on the use of software packages, including design software. Assignments are project-oriented relating to mechanical engineering topics. It is recommended that students take this subject in the first IAP after declaring the major in Mechanical Engineering.
D. P. Hart, D. R. Wallace

2.671 Measurement and Instrumentation
Prereq: 2.001; 2.003; 8.02
U (Fall, Spring)
3-3-6 Institute LAB
Experimental techniques for observation and measurement of physical variables such as force, strain, temperature, flowrate, and acceleration. Emphasizes principles of transduction, measurement circuitry, MEMS sensors, Fourier transforms, linear and nonlinear function fitting, uncertainty analysis, probability density functions and statistics, system identification, electrical-impedance analysis and transfer functions, computer-aided experimentation, and technical reporting. Typical laboratory experiments involve oscilloscopes, electronic circuits including operational amplifiers, thermocouples, strain gauges, digital recorders, lasers, etc. Basic material and lab objectives are developed in lectures. Instruction and practice in oral and written communication provided. Enrollment limited.
I. W. Hunter, J. J. Leonard

2.672 Project Laboratory
Prereq: 2.001, 2.003, 2.006, 2.671
U (Fall, Spring)
1-3-2 1/2 Institute LAB
Engineering laboratory subject for mechanical engineering juniors and seniors. Major emphasis on interplay between analytical and experimental methods in solution of research and development problems. Communication (written and oral) of results is also a strong component of the course. Groups of two or three students work together on three projects during the term. Limited enrollment.
W. Cheng, D. P. Hart

2.673J Biological Engineering II: Instrumentation and Measurement
(Same subject as 20.309J)
(Subject meets with 20.409)
Prereq: 18.03
U (Fall, Spring)
3-6-3
See description under subject 20.309J.
Fall: S. Manalis, P. T. So, M. Shusteff
Spring: M. J. Lang, K. Van Vliet, E. Boyden

2.674 Micro/Nano Engineering Laboratory (New)
Prereq: 2.001; 3.091 or 5.111
U (Spring)
1-4-7
Concepts, ideas and enabling tools of nano science and engineering taught through projects which include learning about MEMS, microfluidics, nanomaterials and characterization tools such as SEM, TEM, STM and AFM. Lab modules utilize the Pappalardo II Laboratory, where students build, observe and manipulate micro- and nano-scale structures while learning about underlying science and engineering principles and potential applications. Designed for undergraduates who want to pursue study in micro/nano technology.
S. G. Kim, T. Thorsen, C. Livermore, G. Chen

OCEANOGRAPHIC ENGINEERING AND ACOUSTICS

2.681 Environmental Ocean Acoustics (New)
Prereq: 2.066, 18.075 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Fundamentals of underwater sound, and its application to mapping and surveillance in an ocean environment. Wave equations for fluid and elastic media. Reflection and transmission of sound at plane interfaces. Wave theory representation of acoustic source radiation and propagation in shallow and deep ocean waveguides. Interaction of underwater sound with elastic waves in the seabed and an Arctic ice cover, including effects of porosity and anisotropy. Numerical modeling of the propagation of underwater sound, including spectral methods, normal mode theory, and the parabolic equation method, for laterally homogeneous and inhomogeneous environments. Doppler effects. Effects of oceanographic variability and fluctuation - spatial and temporal coherence. Genera-
tion and propagation of ocean ambient noise. Modeling and simulation of signals and noise in traditional sonar systems, as well as modern, distributed, autonomous acoustic surveillance systems.
H. Schmidt

2.682 Acoustical Oceanography (New)
Prereq: 2.681
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Provides brief overview of what important current research topics are in oceanography (physical, geological, and biological) and how acoustics can be used as a tool to address them. Three typical examples are climate, bottom geology, and marine mammal behavior. Addresses the acoustic inverse problem, reviewing inverse methods (linear and nonlinear) and the combination of acoustical methods with other measurements as an integrated system. Concentrates on specific case studies, taken from current research journals.
J. F. Lynch, Woods Hole Staff

2.683 Marine Bio-Acoustics and Geo-Acoustics (New)
Prereq: 2.681
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Both active and passive acoustic methods of measuring marine organisms, the seafloor, and their interactions are reviewed. Acoustic methods of detecting, observing, and quantifying marine biological organisms are described, as are acoustic methods of measuring geological properties of the seafloor, including depth, and surficial and volumetric composition. Interactions are also described, including effects of biological scatterers on geological measurements, and effects of seafloor scattering on measurements of biological scatterers on, in, or immediately above the seafloor. Methods of determining small-scale material properties of organisms and the seafloor are outlined. Operational methods are emphasized, and corresponding measurement theory is described. Case studies are used in illustration. Principles of acoustic-system calibration are elaborated.
K. G. Foote, Woods Hole Staff

2.684 Wave Scattering by Rough Surfaces and Inhomogeneous Media (2.691)
Prereq: 2.066
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
An advanced-level subject designed to give students a working knowledge of current techniques in this area. Material is presented principally in the context of ocean acoustics, but can be used in other acoustic and electromagnetic applications. Includes fundamentals of wave propagation through, and/or scattering by: random media, extended coherent structures, rough surfaces, and discrete scatterers.
T. K. Stanton, A. C. Lavery, Woods Hole Staff

2.685 Numerical Methods in Wave Scattering (New)
Prereq: 2.066, 18.06
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Fundamental equations for acoustic and electromagnetic waves are derived from first principles. Boundary, or interface, conditions are introduced. Emphasizes the development of numerical methods to solve wave equations in interior or exterior domains using boundary-element and finite-element techniques. Spectral techniques are also developed. A number of technical computational issues are addressed including discretization of geometry, order of approximation, efficiency, and analysis of numerical schemes. Validation is an essential exercise. Validation examples are drawn from analytical solutions for separable shapes. Applications of numerical methods are presented for acoustic scattering by marine organisms of complex shape and structure, and optical scattering by dielectric bodies. Assignments entail code development.
G. R. Feijoo, K. G. Foote, Woods Hole Staff

2.686j Sonar, Radar, and Seismic Signal Processing (2.163)
(Same subject as 6.455), 12.518)
Prereq: 2.004 or 6.003; 6.041; 18.075 or 18.085
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Signal processing used in sonar, radar, and geophysical data analysis. Active sonar and radar systems: matched filters and ambigu-ity functions, signal design of range/doppler resolution, second moment characterizations of random processes with correlation functions and power density spectra, deconvolution, spectral estimation by Fourier techniques and adaptive methods, beam forming.
M. A. Grosenbaugh, Woods Hole Staff

2.687 Time Series Analysis and System Identification (New)
Prereq: 6.003, 6.431, 18.06
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Matched filtering, power spectral estimation and adaptive signal processing and system identification algorithms are introduced. Algorithm development is framed as an optimization problem, and methods of finding both optimal and approximate solutions are described. Introduction to time-varying systems, first and second moment characterizations of stochastic processes, and state-space models. Algorithm derivation, performance analysis and robustness to modeling errors are covered for matched filter and power spectral estimation algorithms, stochastic gradient algorithms (LMS and its variants), least squares algorithms (RLS, order-recursive approaches), and the discrete-time Kalman Filter and its derivatives. Includes laboratory exercises involving working with experimental data from a variety of fields. Term paper/project is required.
J. C. Preisig

2.688 Principles of Oceanographic Instrument Systems—Sensors and Measurements (2.693)
Prereq: 18.075, 2.671
G (Spring)
3-3-6 H-LEVEL Grad Credit
Introduces theoretical and practical principles of design of oceanographic sensor systems. Transducer characteristics for acoustic, current, temperature, pressure, electric, magnetic, gravity, salinity, velocity, heat flow, and optical devices. Limitations on these devices imposed by ocean environment. Signal conditioning and recording; noise, sensitivity, and sampling limitations; standards. Principles of state-of-the-art systems being used in physical oceanography, geophysics, submersibles, acoustics discussed in lectures by experts in these areas. Day cruises in local waters during which the students will prepare, deploy and analyze observations from standard oceanographic instruments constitute the lab work for this subject.
M. A. Grosenbaugh, Woods Hole Staff
2.689J Special Projects in Oceanographic Engineering
(2.694)
(Same subject as 1.699)
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Special problems in oceanographic engineering, carried out under supervision of members of the staff of the Woods Hole Oceanographic Institution. Given at Woods Hole Oceanographic Institution.

T. K. Stanton, Woods Hole Staff

NAVAL ARCHITECTURE

2.701 Principles of Naval Architecture
Prereq: 2.002 or 2.012
G (Fall)
3-0-9

Introduction to principles of naval architecture, ship geometry, hydrostatics, calculation and drawing of curves of form, intact and damage stability, hull structure strength calculations and ship resistance. Projects include analysis of ship lines drawings and ship model testing.

P. J. Keenan, J. P. Harbour

2.702 Computer-Aided Design and Systems Engineering of Naval Ships
Prereq: 2.701
G (Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit

Introduction to principles of systems engineering, computer-aided naval ship design and analysis tools. Emphasizes utilization of computer-aided tools and application of design principles. Naval ship design and acquisition processes; requirements setting, design philosophy and constraints, selection criteria, design optimization, variant analysis, design trade-offs, analysis of ship design trends, and cost analysis.

P. J. Keenan, J. P. Harbour

2.703 Principles of Naval Ship Design
Prereq: 2.082, 2.20, 2.611, 2.702
G (Fall)
3-1-8 H-LEVEL Grad Credit

Design of surface ship platforms for naval applications; introduction to formal design decision making methods; mathematical and computer models of ship design process; engineering and economic principles governing selection of dimensions and coefficients; influence of hull form and dimensions on seakeeping and ship motions in irregular seas using wave energy spectra and response amplitude operator methods; internal subdivisions for efficient arrangement and maximum survivability; damage stability. Introduction to advanced hullforms. Design projects in application of principles.

P. J. Keenan, J. P. Harbour

2.704 Projects in Naval Ship Conversion Design
Prereq: 2.703
G (Spring)
1-0-5 H-LEVEL Grad Credit

Focus on conversion design of a naval ship. A new mission requirement is defined, requiring significant modification to an existing ship. Requirements setting, design plan formulation, design philosophy and formal decision making methods are used. Technical aspects demonstrate feasibility and desirability. Formal written and verbal reports. Team projects.

P. J. Keenan, J. P. Harbour

2.705 Projects in New Concept Naval Ship Design
Prereq: 2.704
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit

Focus on preliminary design of a new naval ship, fulfilling a given set of mission requirements. Design plan formulation, system level trade-off studies, emphasizes achieving a balanced design and total system integration. Formal written and oral reports. Team projects extend over three terms.

P. J. Keenan, J. P. Harbour

2.706 Sailing Vessel Design
Prereq: 2.701 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-5-4 H-LEVEL Grad Credit

Nautical Architecture review, hydrostatics, hydrodynamics and sail aerodynamics unique to sailing vessels, sail and hull heeling moment constraints, parameters of form found for “good” boats. Hull drag decomposition, structural design based on fundamentals and on “rules” of classification organizations. Individual design project including: hull shape, appendages for side force and control, rig design, dimensions of spars and rigging, and detailed structural design of hull and appendages. CAD and performance prediction are used as design aids. Structural component dimensions, design loads, and design deflections are organized with a computer spreadsheet by each student. Enrollment limited to 25 students.

J. H. Milgram

2.707 Submarine Structural Acoustics
(2.067)
Prereq: 2.066
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-4 H-LEVEL Grad Credit

Introduction to the acoustic interaction of submerged structures with the surrounding fluid. Fluid and elastic wave equations. Elastic waves in plates. Radiation and scattering from planar structures as well as curved structures such as spheres and cylinders. Acoustic imaging of structural vibrations. Taught first half of the term. Students can take 2.085 in the second part of the semester.

H. Schmidt

OPTICS

2.71 Optics
(Subject meets with 2.710)
Prereq: 8.02; 18.03; 2.004 or permission of instructor
U (Spring)
3-0-9

2.710 Optics
(Subject meets with 2.71)
Prereq: 8.02; 18.03; 2.004 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Introduction to optical science with elementary engineering applications. Geometrical optics: ray-tracing, aberrations, lens design, apertures and stops, radiometry and photometry. Wave optics: basic electrodynamics, polarization, interference, wave-guiding, Fresnel and Fraunhofer diffraction, image formation, resolution, space-bandwidth product. Emphasis on analytical and numerical tools used in optical design. Graduate students are required to complete additional assignments with stronger analytical content, and an advanced design project.

G. Barbastathis, P. T. So

2.715J Optical Microscopy and Spectroscopy for Biology and Medicine (New)
(Same subject as 20.487 J)
Prereq: Permission of instructor
G (Fall)
3-0-9

Introduces the theory and the design of optical microscopy and its applications in biology and medicine. The course starts from an overview of basic optical principles allowing an understanding of microscopic image formation and common contrast modalities such as dark field,
phase, and DIC. Advanced microscopy imaging techniques such as total internal reflection, confocal, and multiphoton will also be discussed. Quantitative analysis of biochemical microenvironment using spectroscopic techniques based on fluorescence, second harmonic, Raman signals will be covered. We will also provide an overview of key image processing techniques for microscopic data.

P. T. So, C. Sheppard

2.717J Optical Engineering
(Same subject as MAS.857J)
Prereq: 2.710 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Theory and practice of optical methods in engineering and system design. Emphasis on diffraction, statistical optics, holography, and imaging. Provides engineering methodology skills necessary to incorporate optical components in systems serving diverse areas such as precision engineering and metrology, bio-imaging, and computing (sensors, data storage, communication in multi-processor systems). Experimental demonstrations and a design project are included.

P. T. So, G. Barbastathis

DESIGN

2.72 Elements of Mechanical Design
Prereq: 2.005, 2.007, 2.671
U (Spring)
3-3-6

Advanced subject on modeling, design, integration and best practices for use of machine elements such as bearings, springs, gears, cams and mechanisms. Modeling and analysis of these elements is based upon extensive applications of physics, mathematics and core mechanical engineering principles (solid mechanics, fluid mechanics, manufacturing, estimation, and modeling). These principles are reinforced via laboratory experiences wherein students conduct experiments and disassemble machines and a substantial design project wherein students model, design, fabricate and characterize a mechanical system that is relevant to a real world application. Students master the materials via problems sets that are directly related to, and coordinated with, the deliverables of their project. Student assessment is based upon mastery of the subject materials and the student’s ability to synthesize, model and fabricate a mechanical device subject to engineering constraints (e.g. cost and time/schedule). Limited enrollment.

M. L. Culepepper

2.722J D-Lab: Design
(Same subject as SP.722J)
Prereq: 2.670 or permission of the instructor
U (Spring)
3-0-9

See description under subject SP.722J.

A. B. Smith, J. K. Vandiver, D. R. Wallace

2.737 Mechatronics
Prereq: 6.071 or 6.002; 2.14, 6.302, or 16.30
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-5-4 H-LEVEL Grad Credit

Introduction to designing mechatronic systems, which require integration of the mechanical and electrical engineering disciplines within a unified framework. Significant laboratory-based design experiences form subject’s core. Final project. Topics include: low-level interfacing of software with hardware; use of high-level graphical programming tools to implement real-time computation tasks; digital logic; analog interfacing and power amplifiers; measurement and sensing; electromagnetic and optical transducers; control of mechatronic systems. Enrollment limited to 20.

D. L. Trumper, K. Youssef-Toumi

2.739J Product Design and Development
(Same subject as 15.783J, ESD.32J)
Prereq: 2.009, 15.760, 15.761, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 15.783J.

W. P. Seering

2.744J Product Design
(Same subject as ESD.64J)
Prereq: 2.009
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit

Project-centered subject addressing transformation of ideas into successful products which are properly matched to the user and the market. Students are asked to take a more complete view of a new product and to gain experience with designs judged on their aesthetics, ease of use, and sensitivities to the realities of the marketplace. Lectures on modern design process, industrial design, visual communication, form-giving, mass production, marketing, and environmentally conscious design.

A. H. Slocum, M. L. Culepepper

2.745 Invention (New)
Prereq: Permission of instructor
G (Spring)
3-2-7 H-LEVEL Grad Credit

Exposes students to the culture and methodology of the inventor. Examples of past invention and their impact on technology and society in their historical context. Examines the interplay between analysis and synthesis in the inventive process. Formal methods of promoting synthesis includes classic brainstorming, morphological analysis, and TRIZ theory. Through case studies, examine how feasibility study and proof of concept can be accomplished as well as the cyclical progression of a project through stages of synthesis, analysis and test. Elements of patent law. Majority of student effort is spent inventing. Laboratory time focused on proof of concept.

E. M. Sachs

2.75 Precision Machine Design
Prereq: 2.72 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Intensive coverage of precision engineering theory, heuristics, and applications pertaining to the design of systems ranging from consumer products to machine tools and instruments. Topics covered include: economics, project management and design philosophy; principles of accuracy, repeatability, and resolution; error budgeting; sensors; sensor mounting; systems design; bearings; actuators and transmissions; system integration driven by functional requirements and operating physics. Emphasis on developing creative designs which are optimized by analytical techniques. Problem sets and test first six weeks. Major team-based design project focus last six weeks.

A. H. Slocum, M. L. Culepepper
2.791) Quantitative Physiology: Cells and Tissues (Same subject as 6.021J, 20.370J) (Subject meets with 2.794J, 6.521J, 20.470J, HST.541J) Prereq: 8.02; 18.03; 2.005, 6.002, 6.003, 6.071, 10.301, or permission of instructor G (Fall) 5-2-5
See description under subject 6.021J.
D. M. Freeman, J. Han

2.792) Quantitative Physiology: Organ Transport Systems (Same subject as 6.022J, 20.371J, HST.542J) (Subject meets with 2.796J, 6.522J, 20.471J) Prereq: 18.03, 8.02, or permission of instructor U (Spring) 4-2-6
See description under subject 6.022J.
R. G. Mark, C. M. Stultz

2.793) Fields, Forces and Flows in Biological Systems (Same subject as 6.023J, 20.330J) Prereq: 2.005, 6.021, 20.320 or permission of instructor U (Spring) 4-0-8
See description under subject 20.330J.
J. Han, R. D. Kamm, S. Manalis

2.794) Quantitative Physiology: Cells and Tissues (Same subject as 6.521J, 20.470J, HST.541J) (Subject meets with 2.791J, 6.021J, 20.370J) Prereq: 2.003, 6.002, 6.071, or 10.301; 8.02, 18.03 G (Fall) 5-2-5
See description under subject 6.521J.
D. M. Freeman, J. Han

2.795) Fields, Forces, and Flows in Biological Systems (Same subject as 6.561J, 10.539J, 20.430J, HST.544J) Prereq: 6.013, 2.005, 10.302, or permission of instructor G (Fall) 3-0-9 H-LEVEL Grad Credit
See description under subject 20.430J.
A. J. Grodzinsky, R. D. Kamm

BIOENGINEERING

2.771J Biomedical Information Technology (Same subject as 20.453J, HST.958J) Prereq: —
G (Fall) 3-0-9 H-LEVEL Grad Credit
See description under subject 20.453J.
C. F. Dewey, Jr., S. Bhowmik (NTU, Singapore)

2.772J Thermodynamics of Biomolecular Systems (Same subject as 20.110J) Prereq: 18.02; 5.111, 5.112, or 3.091 G (Fall) 5-0-7 REST
See description under subject 20.110J.
K. Hamad-Schifferli, L. G. Griffith

2.782J Design of Medical Devices and Implants (Same subject as 3.961J, 20.451J, HST.524J) Prereq: 2.79J or permission of instructor G (Spring) 3-0-9 H-LEVEL Grad Credit
I. V. Yannas, M. Spector

2.785J Cell-Matrix Mechanics (Same subject as 3.97J, 20.411J, HST.523J) Prereq: 3.091, 5.11, 5.111, or 5.112; 2.005 or 5.60; 7.012, 7.013, 7.014, or 7.015 G (Spring) 3-0-9 H-LEVEL Grad Credit
Mechanical forces play a decisive role during development of tissues and organs, during remodeling following injury as well as in normal function. A stress field influences cell function primarily through deformation of the extracellular matrix to which cells are attached. Deformed cells express different biosynthetic activity relative to undeformed cells. The unit cell process paradigm combined with topics in connective tissue mechanics form the basis for discussions of several topics from cell biology, physiology, and medicine.
I. V. Yannas, M. Spector

2.791J Quantitative Physiology: Cells and Tissues (Same subject as 6.021J, 20.370J) (Subject meets with 2.794J, 6.521J, 20.470J, HST.541J) Prereq: 8.02; 18.03; 2.005, 6.002, 6.003, 6.071, 10.301, or permission of instructor G (Fall) 5-2-5
See description under subject 6.021J.
D. M. Freeman, J. Han

2.792J Quantitative Physiology: Organ Transport Systems (Same subject as 6.022J, 20.371J, HST.542J) (Subject meets with 2.796J, 6.522J, 20.471J) Prereq: 18.03, 8.02, or permission of instructor U (Spring) 4-2-6
See description under subject 6.022J.
R. G. Mark, C. M. Stultz

2.793J Fields, Forces and Flows in Biological Systems (Same subject as 6.023J, 20.330J) Prereq: 2.005, 6.021, 20.320 or permission of instructor U (Spring) 4-0-8
See description under subject 20.330J.
J. Han, R. D. Kamm, S. Manalis

2.794J Quantitative Physiology: Cells and Tissues (Same subject as 6.521J, 20.470J, HST.541J) (Subject meets with 2.791J, 6.021J, 20.370J) Prereq: 2.003, 6.002, 6.071, or 10.301; 8.02, 18.03 G (Fall) 5-2-5
See description under subject 6.521J.
D. M. Freeman, J. Han

2.795J Fields, Forces, and Flows in Biological Systems (Same subject as 6.561J, 10.539J, 20.430J, HST.544J) Prereq: 6.013, 2.005, 10.302, or permission of instructor G (Fall) 3-0-9 H-LEVEL Grad Credit
See description under subject 20.430J.
A. J. Grodzinsky, R. D. Kamm
2.796J Quantitative Physiology: Organ Transport Systems
(Same subject as 6.522J, 20.471J)
(Subject meets with 2.792J, 6.022J, 20.371J, HST.542J)
Prereq: 2.006 or 6.013J; 6.021J
G (Spring)
4-2-6
See description under subject 6.522J.
R. G. Mark

2.797J Molecular, Cellular, and Tissue Biomechanics
(Same subject as 3.053J, 6.024J, 20.310J)
Prereq: 18.03 or 3.016J; 7.012, 7.013, 7.014, or 7.015; 2.370 or 2.772J
U (Spring)
4-0-8
Develops and applies scaling laws and the methods of continuum mechanics to biomechanical phenomena over a range of length scales. Topics include structure of tissues and the molecular basis for macroscopic properties; chemical and electrical effects on mechanical behavior; cell mechanics, motility and adhesion; biomembranes; biomolecular mechanics and molecular motors. Experimental methods for probing structures at the tissue, cellular, and molecular levels.
M. J. Long, R. D. Kamm

2.798J Molecular, Cellular, and Tissue Biomechanics
(Same subject as 3.971J, 6.524J, 10.537J, 20.410J)
Prereq: 7.012, 2.002, 2.006, 6.013J, 6.014, 10.301, or 10.302
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.410J.
A. J. Grodzinsky, P. Doyle, S. Suresh

MANUFACTURING

2.800 Tribology
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Fundamental mechanisms of friction and wear. Design of tribological systems. Topics include geometric, chemical, and physical characterization of surfaces; friction and wear mechanisms for metals, polymers, and ceramics, including abrasive wear, delamination theory, solution wear, erosive wear, wear of polymers and composites; and boundary lubrication and solid-film lubrication; relationship between nano-tribology and macro-tribology, rolling contacts, tribological problems in magnetic recording and electrical contacts, and monitoring and diagnosis of friction and wear. Case studies.
N. P. Suh, N. Saka

2.810 Manufacturing Processes and Systems
Prereq: 2.001, 2.006, 2.008
G (Fall)
3-3-6 H-LEVEL Grad Credit
Introduction to manufacturing processes and manufacturing systems including assembly, machining, injection molding, casting, thermoforming, and more. Emphasis on the physics and randomness and how they influence quality, rate, cost, and flexibility. Attention to the relationship between the process and the system, and the process and part design. Project (in small groups) requires fabrication (and some design) of a product using several different processes (as listed above).
T. G. Gutowski

2.813 Environmentally Benign Design and Manufacturing
(Subject meets with 2.83)
Prereq: 2.008 or permission of instructor
U (Spring)
3-0-9
Introduction to the major dilemma that faces manufacturing and society for the 21st century; how to support economic development while protecting the environment. Subject addresses industrial ecology, materials flows, life cycle analysis, thermodynamic analysis and exergy accounting, manufacturing process performance, product design analysis, design for the environment, recycling and ecological economics. Class follows a mixed format with lectures and group discussions of journal articles and selected literature, often with opposing views. Graduate students complete term-long project with report required for graduate credit.
T. G. Gutowski

2.821J Fabrication Technology
(Subject meets with 3.371J)
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
4-0-5 H-LEVEL Grad Credit
See description under subject 3.371J.
T. W. Eagar

2.83 Environmentally Benign Design and Manufacturing
(Subject meets with 2.813)
Prereq: 2.810 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.813.
T. G. Gutowski

2.830J Control of Manufacturing Processes
(Same subject as 6.780J, ESD.63J)
Prereq: 2.08, 2.810, 2.751J, 6.152J, or 6.041
G (Spring)
3-0-9 H-LEVEL Grad Credit
Statistical modeling and control in manufacturing processes. Use of experimental design and response surface modeling to understand manufacturing process physics. Defect and parametric yield modeling and optimization. Forms of process control, including statistical process control, run by run and adaptive control, and real-time feedback control. Application contexts include semiconductor manufacturing, conventional metal and polymer processing, and emerging micro-nano manufacturing processes.
D. E. Hardt, D. S. Boning

2.851J System Optimization and Analysis for Manufacturing
(Same subject as 15.066J, ESD.750J)
Prereq: 18.02
G (Summer)
4-0-8 H-LEVEL Grad Credit
See description under subject 15.066J.
S. C. Graves, J. P. Clark, J. Gallien

2.852 Manufacturing Systems Analysis
Prereq: 6.041 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Models of manufacturing systems, including transfer lines and flexible manufacturing systems. Calculation of performance measures, including throughput, in-process inventory, and meeting production commitments. Real-time control of scheduling. Effects of machine failure, set-ups, and other disruptions on system performance.
S. B. Gershwin
2.853 Introduction to Manufacturing Systems
(Subject meets with 2.854)
Prereq: 2.008
U (Fall)
3-0-9

2.854 Introduction to Manufacturing Systems
(Subject meets with 2.853)
Prereq: Undergraduate mathematics
G (Fall)
3-0-9 H-LEVEL Grad Credit

Provides ways to analyze manufacturing systems in terms of material flow and storage, information flow, capacities, and times and durations of events. Fundamental topics include probability, inventory and queuing models, forecasting, optimization, process analysis, and linear and dynamic systems. Factory planning and scheduling topics include flow planning, bottleneck characterization, buffer and batch-size tactics, seasonal planning, and dynamic behavior of production systems. Graduate students are required to complete additional assignments.
S. B. Gershwin

2.875J Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development
(Same subject as ESD.875J)
Prereq: 2.008
G (Fall)
3-0-9 H-LEVEL Grad Credit

Introduces mechanical and economic models of assemblies and assembly automation on two levels. Assembly in the small comprises basic engineering models of rigid and compliant part mating and explains the operation of the Remote Center Compliance. Assembly in the large takes a systems view of assembly, including the notion of product architecture, feature-based design, and computer models of assemblies, analysis of mechanical constraint, assembly sequence analysis, tolerances, system-level design for assembly and JIT methods, and economics of assembly automation. Case studies and current research included. Class exercises and homework include analyses of real assemblies, the mechanics of part mating, and a semester long project.
D. E. Whitney

2.882 System Design and Analysis
Prereq: 2.004, 2.006
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

N. P. Suh, T. Lee

2.888 Professional Seminar in Global Manufacturing Innovation and Entrepreneurship
Prereq: —
G (Spring)
2-0-1

Covers a broad range of topics in modern manufacturing, from models and structures for 21st century operations, to case studies in leadership from the shop floor to the executive office. Also includes global perspectives from Asia, Europe and North America, with guest speakers from all three regions. Opportunities for new ventures in manufacturing are explored. Intended primarily for Master of Engineering in Manufacturing students.
D. E. Hardt, S. B. Gershwin

2.890J Proseminar in Manufacturing
(Same subject as 3.80J, 10.792J, 15.792J, 16.985J)
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
See description under subject 15.792J.
D. B. Rosenfield

ENGINEERING MANAGEMENT

2.961 Management in Engineering
(Subject meets with 2.961, 6.930J, 10.806J, 16.653J)
Prereq: —
U (Fall)
3-1-8

2.961 Management in Engineering
(Subject meets with 2.961, 6.930J, 10.806J, 16.653J)
Prereq: —
G (Fall)
3-1-8

Introduction and overview of engineering management. Financial principles, management of innovation, technical strategy and best management practices. Case study method of instruction emphasizes participation in class discus-

2.963 Engineering Risk-Benefit Analysis
Engineering School-Wide Elective Subject.
(Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.72.
G. E. Apostolakis

2.964 Economics of Marine Transportation Industries
Prereq: 14.01 or permission of instructor
G (Fall)
3-0-3 H-LEVEL Grad Credit

Studies the economics of the principal markets related to marine transportation, environment, and natural resources. Structures of the markets and industries involved; competition; impacts of policies and regulations. Analysis of the relationship among industries, markets, technologies, and national policies. Introduces the concepts of national income accounts, sustainability, and intergenerational equity and their relationship to current economic practice. Meets second half of term.
H. L. Kite-Powell, H. S. Marcus

2.965J International Supply Chain Management
(Same subject as 1.265J, 15.765J, ESD.265J)
Prereq: 1.260J, 1.261J, 1.262J, 15.760, or permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

An overview of globalization and the international environment: the international marketing, international finance and supply chain interface; global strategy for logistics and supply chain management; global supply chain models; role of government intervention and regulations; the role of ports and airports in international product movements; the economics of international air and ocean carriers; and the forwarding industry. First half term subject.
H. S. Marcus, A. Weiss

MECHANICAL ENGINEERING
2.966 Management of Marine Systems
Prereq: Permission of instructor
G (Fall)
3-0-3 H-LEVEL Grad Credit
Analyzes current technological, market, and regulatory trends in various segments of the marine industry and government development programs such as liner trades, vessel chartering, shipbuilding, defense systems, and coastal facilities; description of resources and constraints involved; impact of trends on management decisions; analysis of problems actually existing in the field. Meets during first half of term.
H. S. Marcus

2.967 International Shipping
Prereq: 2.966 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Explores internal policy, operating, financial, and marketing issues as well as external market and technological factors that define the international shipping environment. Includes effect of world energy prices and changing trade patterns upon demand for shipping; evaluation of shipping capacity requirements in terms of capital needs; new ship and terminal technologies; impacts of legislative and regulatory requirements, and effect of changing international relationships.
H. S. Marcus

SPECIAL STUDIES

2.97, 2.971–2.974 Independent Activities
Prereq: —
U (IAP)
Units arranged
Can be repeated for credit
For undergraduates desiring to carry on independent or group studies during the January Independent Activities Period. Each student will carry on a program of his or her own choosing, either as an independent worker, or as a member of a team or class. Special lectures, seminars, and laboratory projects arranged when appropriate. Programs arranged on an individual basis in consultation with the instructor. 2.972–2.974 are graded P/D/F.
Consult J. H. Lienhard

2.979 Undergraduate Teaching
Prereq: —
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
For students participating in departmentally approved undergraduate teaching programs. Students assist faculty in the design and execution of the curriculum and actively participate in the instruction and monitoring of the class participants. Students prepare subject materials, lead discussion groups, and review progress. Credit is arranged on a subject-by-subject basis and is reviewed by the department.
J. H. Lienhard

SPECIAL AND ADVANCED TOPICS IN MECHANICAL ENGINEERING

Check with our Department graduate office prior to the beginning of each term for other proposed listings.

2.993–2.995 Special Topics in Mechanical Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Designed for undergraduates wanting to continue substantial projects of own choice, under faculty supervision, in mechanical engineering. Work may be of experimental, theoretical, or design nature. Projects may be arranged individually in most fields of department interest, i.e., in mechanics, design and manufacturing, controls and robotics, thermal science and energy engineering, bioengineering, ocean engineering and nanotechnology.
Consult J. H. Lienhard

2.996–2.998 Advanced Topics in Mechanical Engineering
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Assigned reading and special problems or research in special areas, either theoretical or experimental, or design. Arranged on individual basis with instructor in the following areas: mechanics and materials, thermal and fluid sciences, systems design, and biomedical engineering, and ocean engineering. Can be repeated for credit only for completely different subject matter.
Consult L. Anand

THESIS, RESEARCH AND PRACTICE

2.999 Engineer’s Degree Thesis Proposal Preparation
Prereq: —
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
For students who must do additional work to convert an SM thesis to an ME thesis, or for students who write an ME thesis after having received an SM degree.
L. Anand, M. S. Triantafyllou

2.EPE UPOP Summer Practice Experience
Engineering School-Wide Elective Subject. (Offered under: 1.EPE, 2.EPE, 3.EPE, 10.EPE, 16.EPE, 22.EPE)
Prereq: 2.EPW or permission of instructor
U (Fall, Spring)
0-1-0 [P/D/F]
Can be repeated for credit
Provides engineering students, typically sophomores, the opportunity to participate in engineering practice. Students gain experience with recruitment and job selection, the job experience, and the assessment and reflection process. Spring term includes seminars and workshops in preparation for internship and management of career path. With the assistance of UPOP staff, students find and engage in a 10–12-week summer job experience, during which they maintain a journal of their experiences. In the Fall term, students write essays addressing the topics introduced in UPOP EPW workshop during IAP, complete a post-summer self-evaluation form, and discuss these forms with their regular academic advisor. Students have the opportunity to share their experiences with others in a roundtable discussion. Can be taken up to two times for credit. Spring term can only be taken in conjunction with the Fall term.
D. K. P. Yue
2.EPR UPOP Reflective Learning Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPR, 2.EPR, 3.EPR, 10.EPR, 16.EPR, 22.EPR)
Prereq: 2.EPE or permission of instructor
U (Fall)
0-0-3 [P/D/F]
Provides engineering sophomores the opportunity to reflect and share their summer practice experiences as related to the topics of the IAP subject and students' academic subjects through a written report and an oral presentation delivered at a UPOP Symposium in the fall. D. K. P. Yue

2.EPW UPOP IAP Workshop
Engineering School-Wide Elective Subject.
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW, 10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]
Provides engineering sophomores the opportunity to build the core foundation of skills necessary to succeed in and prepare for a summer practice experience. Introduces concepts in product development, system dynamics, organizational dynamics, and effective communication. Also introduces concepts in ethics and character, and leadership and teamwork to ensure that students acquire an appreciation of the social, environmental, and ethical implications of organizational decision making. Subject is an interactive experience integrating lectures with role-playing, simulations, and group projects, where students apply these concepts in a case study context. Students are provided with a journal to be used during their summer training practice. Limited enrollment. D. K. P. Yue

2.THA Undergraduate Thesis for Course 2-A
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Students in Course 2-A must take a minimum of 12 units during their senior year. A 3-unit component must be taken in the fall of the senior year to prepare a detailed thesis proposal under the guidance of the staff from the Writing Program. The thesis proposal must bear the endorsement of the thesis supervisor and indicate the number of units planned. For Course 2-A students who are not taking 2.009, the thesis must have significant design content. The design content is verified jointly by the thesis supervisor and the Course 2-A coordinator. Consult J. H. Lienhard

2.ThG Graduate Thesis
Prereq: Permission of advisor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of graduate research, leading to the writing of an SM, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member. Consult L. Anand

2.ThU Undergraduate Independent Study or Thesis
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Individual self-motivated study, research, or design project under faculty supervision. Departmental program requirement: Minimum of 6 units. Instruction and practice in written communication provided. Consult J. H. Lienhard

2.UR Undergraduate Research in Mechanical Engineering
Prereq: —
U (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Individual study, research, or laboratory investigations under faculty supervision, including individual participation in an ongoing research project. See projects listing in Undergraduate Office, 1-110, for guidance. Consult J. H. Lienhard
3.012 Fundamentals of Materials Science and Engineering
Prereq: 18.03, 18.034, or 3.016
U (fall)
5-0-10 REST
Describes the fundamentals of structure, energetics, and bonding that underpin materials science. Introduction to thermodynamic functions and laws governing equilibrium properties, relating macroscopic behavior to atomic and molecular models of materials. The role of electronic bonding in determining the energy, structure, and stability of materials. Quantum mechanical descriptions of interacting electrons and atoms. Materials phenomena, such as heat capacities, phase transformations, multiphase equilibria, chemical reactions, and magnetism. Structure of noncrystalline, crystalline, and liquid-crystalline states. Symmetry and tensor properties of materials. Point, line, and surface imperfections in materials. Diffraction and structure determination. Real-world examples such as engineered alloys, electronic and magnetic materials, ionic and network solids, polymers, and biomaterials.
S. Gradecak, F. Stellacci

3.014 Materials Laboratory
Prereq: ---
U (fall)
1-4-7 Institute LAB
Experimental exploration of the connections between energetics, bonding and structure of materials, and application of these principles in instruments for materials characterization. Demonstration of the wave-like nature of electrons. Hands-on experimentation with techniques to quantify energy (DSC), bonding (XPS, AES, FTIR, UV/vis and force spectroscopy), and degree of order (X-ray scattering) in condensed matter. Investigation of structural transitions and structure-property relationships through practical materials examples. Practice in oral and written technical communication. It is strongly recommended that 3.012 and 3.014 are taken simultaneously.
S. Gradecak, F. Stellacci

3.016 Mathematical Methods for Materials Scientists and Engineers
Prereq: 18.02
U (fall)
3-1-8
Mathematical techniques necessary for materials science and engineering topics such as energetics, materials structure and symmetry, materials response to applied fields, mechanisms and physics of solids and soft materials. Mathematical concepts and materials-related problem solving skills. Symbolic algebraic computational methods, programming, and visualization techniques. Topics include linear algebra, quadratic forms, tensor operations, symmetry operations, calculus of several variables, eigensystems, introduction to complex analysis, systems of ordinary and partial differential equations, phase plane analysis, beam theory, resonance phenomena, special functions, numerical solutions, statistical analysis, Fourier analysis, and random walks.
W. C. Carter

3.021 Introduction to Modeling and Simulation Engineering School-Wide Elective Subject.
(Offered under: 1.021, 2.088, 3.021, 10.333, 18.361, 22.00, HST.558)
Prereq: 18.03
U (spring)
3-0-9 REST
See description under subject 22.00.
M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Radovitzky, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

3.022 Microstructural Evolution in Materials
Prereq: 3.012
U (spring)
3-3-6
Microstructures, defects, and structural evolution in all classes of materials. Topics include dislocations and point defects, diffusion, surface energetics, grains and grain boundaries, grain growth, nucleation and precipitation, interface stability, solution kinetics and electrochemical reactions. The lectures are widely illustrated with examples and applications based on metals, ceramics, electronic materials and polymers. Experimental exploration of the evolution of microstructure, including experimentation using optical and electron microscopy, calorimetry, and other characterization methods. Investigations include structural transitions and structure-property relationships through practical materials examples.
M. Cima, L. Hobbs

3.024 Electronic, Optical and Magnetic Properties of Materials
Prereq: 3.012
U (spring)
3-3-6
Describes how the electronic, optical and magnetic properties of materials originate from their electronic and molecular structure and how these properties can be designed for particular applications, for instance in optical fibers, magnetic data storage, solar cells, transistors and other devices. Experimental exploration of the electronic, optical and magnetic properties of materials. Includes hands-on experimentation using spectroscopy, resistivity, impedance and magnetometry measurements, behavior of light in waveguides, and other characterization methods. Investigation of structure-property relationships through practical materials examples.
N. Marzari, L. Hobbs

3.032 Mechanical Behavior of Materials
Prereq: 8.01; 3.016 or 18.03
U (fall)
4-2-6
Basic concepts of solid mechanics and mechanical behavior of materials, stress-strain relationships, stress transformation, elasticity, plasticity and fracture. Case studies include materials selection for bicycle frames, stress shielding in biomedical implants; residual stresses in thin films; and ancient materials. Lab experiments and demonstrations give hands-on experience of the physical concepts at a variety of length scales. Use of facilities for measuring mechanical properties including standard mechanical tests, bubble raft models, atomic force microscopy and nanoindentation.
C. Ortiz, K. J. Van Vliet
3.034 Organic and Biomaterials Chemistry  
Prereq: 3.012  
U (Fall)  
4-2-6  
Focuses on the chemistry and chemical structure-property relationships of soft synthetic and biologically derived materials. Topical coverage includes: methods for preparing synthetic polymers by step and chain growth polymerizations; polymerization reaction kinetics; chemistry of proteins, nucleic acids, polysaccharides and lipids, and their incorporation into biomaterials and biosensors; enzymatic reactions and ligations; chemical modification and patterning of organic and inorganic surfaces using organosilane and self-assembled monolayer chemistries, radiation grafting, physisorption and microcontact printing; organic systems as templates for inorganic materials; sol gel syntheses, polymer precursor conversions, polymer vesicle nanoreactors; chemical degradation of soft materials through reaion, hydrolysis, and thermolysis; electroactive organic materials. First-hand application of lecture topics is obtained through design-oriented experiments.  
A. Belcher, M. F. Rubner  

3.035, 3.036, 3.037 Special Problems in Materials Science and Engineering  
Prereq: Permission of instructor  
U (Fall, IAP, Spring, Summer)  
Units arranged [P/D/F]  
Can be repeated for credit  

3.038, 3.039, 3.04 Special Problems in Materials Science and Engineering  
Prereq: Permission of instructor  
U (Fall, IAP, Spring, Summer)  
Units arranged  
Can be repeated for credit  
For undergraduates desiring to carry on projects of their own choosing, which may be experimental, theoretical, or of a design nature. Also for undergraduate studies arranged by students or staff, which may consist of seminars, assigned reading, or laboratory projects. See UROP Coordinator for registration procedures.  
B. J. Wuensch  

3.042 Materials Project Laboratory  
Prereq: 3.014, 3.032 or 3.044  
U (Fall, Spring)  
1-6-5  
Student project teams design and fabricate a materials engineering prototype using processing technologies (e.g. injection molding, thermoforming, investment casting, powder processing, three-dimensional printing, physical vapor deposition) appropriate for the materials and device of interest. Goals include using MSE fundamentals in a practical application; understanding trade-offs between design, processing and performance; and fabrication of a deliverable prototype. Emphasis on teamwork, project management, communications and computer skills, and hands-on work using student and MIT laboratory shops. Teams document their progress and final results by means of written and oral communication.  
Fall: E. A. Fitzgerald  
Spring: D. Roylance  

3.044 Materials Processing  
Prereq: 3.012, 3.022  
U (Spring)  
4-0-8  
How materials are processed, including diffusion, chemical reactions and solid-state phase transformations. Covers heat and mass transport, fluid flow during materials processing, and the economics of materials processing and recycling.  
C. Schuh  

3.046 Thermodynamics of Materials  
Prereq: 18.03, 18.034, or 3.016  
Acad Year 2007–2008: U (Spring)  
Acad Year 2008–2009: Not offered  
4-0-8 REST  
The laws of thermodynamics and their application to equilibrium and the properties of materials. Foundation to treat general phenomena in materials science and engineering, including chemical reactions, magnetism, polarizability, and elasticity. Relations pertaining to multi-phase equilibria as determined by a treatment of solution thermodynamics. Graphical constructions that are essential for the interpretation of phase diagrams. Electrochemical equilibria and surface thermodynamics. Aspects of statistical thermodynamics as they relate to macroscopic equilibrium phenomena.  
W. C. Carter  

3.048 Advanced Materials Processing  
(Subject meets with 3.521, 10.581J)  
Prereq: 3.022, 3.044  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9  
Fundamentals of materials processing. Building engineering structures from the atomic- and nano-scales to macroscopic levels. Case studies illustrating application of processing science to creation of modern metallic, ceramic, polymeric and biomaterials devices and components.  
C. Schuh, M. C. Flemings  

3.051 Materials for Biomedical Applications  
(Subject meets with 20.340)  
Prereq: 3.091, 5.11, 5.111, or 5.112; 7.012, 7.013, 7.014, or 7.015; 3.00 or 3.012; 5.60 or 2.005  
Acad Year 2007–2008: U (Spring)  
Acad Year 2008–2009: Not offered  
3-0-9  
D. Irvine  

3.052 Nanomechanics of Materials and Biomaterials  
Prereq: 3.032, 3.11, or permission of instructor U (Spring)  
3-0-9  
Latest scientific developments and discoveries in the field of nanomechanics, i.e. the deformation of extremely tiny (10-9 meters) areas of synthetic and biological materials. Lectures include a description of normal and lateral forces at the atomic scale, atomistic aspects of adhesion, nanoindentation, molecular details of fracture, chemical force microscopy, elasticity of individual macromolecular chains, intermolecular interactions in polymers, dynamic force spectroscopy, biomolecular bond strength measurements, and molecular motors.  
C. Ortiz  

3.053 Molecular, Cellular, and Tissue Biomechanics  
(Same subject as 2.797J, 6.024J, 20.310J)  
Prereq: 18.03 or 3.016; 7.012, 7.013, 7.014, or 7.015; 2.370 or 2.772J  
U (Spring)  
4-0-8  
See description under subject 2.797J.  
M. J. Long, R. D. Kamm  

3.063 Polymer Physics  
Prereq: 3.012  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
4-0-8  
The mechanical, optical, and transport properties of polymers are presented with respect to the underlying physics and physical chemistry of polymers in melt, solution, and solid state.
Topics include conformation and molecular dimensions of polymer chains in solutions, melts, blends, and block copolymers. Examination of the structure of glassy, crystalline, and rubbery elastic states of polymers; thermodynamics of polymer solutions, blends, crystallization; liquid crystallinity, microphase separation, and self-assembled organic-inorganic nanocomposites. Case studies of relationships between structure and function in technologically important polymer systems.

E. L. Thomas

3.064 Polymer Engineering
Prereq: 3.032, 3.044
U (Fall)
3-0-9
Overview of engineering analysis and design techniques for synthetic polymers. Treatment of materials properties selection, mechanical characterization, and processing in design of load-bearing and environment-compatible structures.

D. K. Roylance

3.07 Introduction to Ceramics
Prereq: 3.012
U (Fall)
3-0-9
Discusses structure-property relationships in ceramic materials. Includes hierarchy of structures from the atomic to microstructural levels. Defects and transport, solid-state electrochemical processes, phase equilibria, fracture and phase transformations are discussed in the context of controlling properties for various applications of ceramics. Numerous examples from current technology.

L. Hobbs

3.070J Communicating About Technology: Colossal Failures in Engineering
(Same subject as 1.588J, 22.002J, 21W.781J, ESD.032J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
See description under subject 21W.781J.
T. Eagar, W. Haas, A. Kadak, P. Lagacé

3.072 Symmetry, Structure and Tensor Properties of Materials
(Same subject as 3.580J)
Prereq: 3.016 or 18.03
U (Fall)
4-0-8
Derivation of symmetry theory; lattices, point groups, space groups, and their properties. Use of symmetry in tensor representation of crystal properties, including anisotropy, representation surfaces, as well as applications to piezoelectricity and elasticity.

B. J. Wuenesch

3.073 Diffraction and Structure
(Subject meets with 3.271)
Prereq: 18.03, 3.024
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8

B. J. Wuenesch

3.074 Imaging of Materials (New)
(Subject meets with 3.34)
Prereq: 3.024, 3.073, or permission of instructor
U (Spring)
3-0-9
Principles and applications of imaging techniques for materials characterization including transmission and scanning electron microscopy and scanning probe microscopy. Topics include electron diffraction; image formation in transmission and scanning electron microscopy; diffraction and phase contrast; imaging of crystals and crystal imperfections; review of the most recent advances in electron microscopy for bio- and nanosciences; analysis of chemical composition and electronic structure at the atomic scale. Lectures, real-case studies and computer simulations.

S. Gradecak

3.080 Economic and Environmental Materials Selection
Prereq: 3.012, 3.014, 3.022, 3.024, or permission of instructor
U (Fall)
3-0-9
Provides a survey of methods for evaluating choice of material and explores the implications of that choice. Topics include choice of materials, manufacturing economics, and life-cycle environmental evaluation. Students carry out a group project selecting materials technology options based on economic and environmental characteristics.

R. Kirchain

3.091 Introduction to Solid-State Chemistry
Prereq: —
U (Fall, Spring)
5-0-7 CHEMISTRY
Basic principles of chemistry and their application to engineering systems. The relationship between electronic structure, chemical bonding, and atomic order. Characterization of atomic arrangements in crystalline and amorphous solids: metals, ceramics, semiconductors, and polymers (including proteins). Topical coverage of organic chemistry, solution chemistry, acid-base equilibria, electrochemistry, biochemistry, chemical kinetics, diffusion, and phase diagrams. Examples from industrial practice (including the environmental impact of chemical processes), from energy generation and storage (e.g. batteries and fuel cells), and from emerging technologies (e.g. photonic and biomedical devices).

Fall: D. R. Sadoway
Spring: D. Paul

3.093 Information Exploration: Becoming a Savvy Scholar
Prereq: 3.091
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
0-1-2
Explores the scientific publication cycle: primary vs. secondary sources, bibliographic databases, both online and in print. Learn how to search, find, evaluate, and cite information. Indexing and abstracting, special resources (e.g. patents), “grey literature” (such as technical reports and conference proceedings), and Web searches. Students construct literature reviews. Limited to freshman.

D. Sadoway, A. Locknar

3.094 Materials in Human Experience
Prereq: —
U (Spring)
2-3-4 HASS
Examines the ways in which people in ancient and contemporary societies have selected, evaluated, and used materials of nature, transforming them to objects of material culture. Some examples: glass in ancient Egypt and Rome; sounds and colors of powerful metals in Mesoamerica; cloth and fiber technologies in the Inca empire. Explores ideological and aesthetic criteria often influential in materials development. Laboratory/workshop sessions provide hands-on experience with materials.
discussed in class. Subject complements 3.091. Enrollment may be limited.

D. Hosler, L. W. Hobbs, H. N. Lechtman

3.14 Physical Metallurgy
Prereq: 3.012, 3.022, 3.032
U (Spring)
3-0-9

Focuses on the links between the processing, structure, and properties of metals and alloys. First, the physical bases for strength, stiffness, and ductility are discussed with reference to crystallography, defects, and microstructure. Second, phase transformations and microstructural evolution are studied in the context of alloy thermodynamics and kinetics. Together, these components comprise the modern paradigm for designing metallic microstructures for optimized properties. Concludes with a focus on processing/structure/property relationships in structural engineering alloys, particularly steels and aluminum alloys.

K. Russell

3.15 Electrical, Optical, and Magnetic Materials and Devices
Prereq: 3.024
U (fall)
4-0-8

Explores the relationships which exist between the performance of electrical, optical, and magnetic devices and the microstructural characteristics of the materials from which they are constructed. Features a device-motivated approach which places strong emphasis on emerging technologies. Device applications of physical phenomena are considered, including electrical conductivity and doping, transistors, photodetectors and photovoltaics, luminescence, light emitting diodes, lasers, optical phenomena, photonics, ferromagnetism, and magneto-resistance.

C. A. Ross

3.153 Nanoscale Materials
Prereq: 3.024
U (Spring)
4-0-8

Introduction to the most recent advances in the synthesis, lithographic patterning and characterization of nanomaterials and to their physical and electronic properties. The materials presented include semiconductor and metal nanoparticles and nanowires, carbon fullerences and nanotubes, organic nanoparticles and dendrimers. Fundamental concepts of surface physics and chemistry used to explain the working principles of devices such as nanotransistors and nanosensors.

F. Stellacci

3.155J Micro/Nano Processing Technology
(Same subject as 6.152J)
Prereq: Permission of instructor
U (Fall, Spring)
3-4-5

See description under subject 6.152J.


3.172 Inventions and Patents
Engineering School-Wide Elective Subject.
(Offered under: 3.172, 6.901, 16.652)
Prereq: 14.02
U (Fall)
3-0-6

History of private and public rights in scientific discoveries and applied engineering, leading to the development of worldwide patent systems. The classes of invention protectable under the patent laws of the US, including the procedures in protecting inventions in the Patent Office and the courts. Reviews of past cases involving inventions and patents in a) the chemical process industry and medical pharmaceutical, biological, and genetic-engineering fields; b) devices in the mechanical, ocean exploration, civil, and/or aeronautical fields; c) the electrical, computer, software, and electronic areas, including key radio, solid-state, computer and software inventions; and also d) software protection afforded under copyright laws. Conducting periodic joint real-time class sessions and discussions by video-audio Internet conferencing, with other universities. Enrollment limited.

R. H. Rines

3.201 Advanced Engineering Internship
Prereq: Permission of instructor
G (IAP, Spring, Summer)
4-0-8 H-LEVEL Grad Credit
Can be repeated for credit

Provides academic credit for students in the Course 3 MEng program for approved off-campus work assignments in industry. Students participate in engineering projects and technology assessment under the supervision of a departmental faculty advisor.

E. A. Fitzgerald

3.202 Advanced Industrial Internship
Technology Development
Prereq: 3.15
G (IAP, Spring, Summer)
4-0-8 H-LEVEL Grad Credit

Students explore in-depth projects on a particular materials-based technology. Students are expected to investigate the science and technology of materials advances and their strategic value; explore potential applications for fundamental advances; and determine intellectual property related to the materials technology and applications. Students map progress with presentations, and are expected to create an end-of-term document enveloping technology, intellectual property, applications, and potential commercialization. In addition to lectures, outside speakers present their expertise in technology, entrepreneurship, intellectual property, and commercialization of materials technologies. All lectures and speaker’s presentations are videotaped, digitized and put on the web for internship students to view. Registration is restricted to students enrolled in the Course 3 MEng Program who are off-campus working at an industrial site.

E. A. Fitzgerald

3.205 Thermodynamics and Kinetics of Materials
Prereq: 3.022, 3.042
G (Fall)
4-0-8 H-LEVEL Grad Credit


G. Ceder, N. Marzari
3.206 Introduction to Materials Engineering Practice
Prereq: 3.091
G (Fall)
1-0-2 H-LEVEL Grad Credit
Introduction to methods of technology research and development in materials-based fields. Seminar-based methodology, employing speakers from inside and outside MIT.
E. A. Fitzgerald

3.207 Technology Development and Evaluation
Prereq: 3.024, 3.15
G (Spring)
4-0-8 H-LEVEL Grad Credit
Students explore in-depth projects on a particular materials-based technology. Students are expected to investigate the science and technology of materials advances and their strategic value; explore potential applications for fundamental advances; and determine intellectual property related to the materials technology and applications. Students map progress with presentations, and are expected to create an end-of-term document enveloping technology, intellectual property, applications, and potential commercialization. In addition to classroom lectures, outside speakers present their expertise in technology, entrepreneurship, intellectual property, and commercialization of materials technologies.
E. A. Fitzgerald

3.21 Kinetic Processes in Materials
Prereq: 3.012, 3.022, 3.044, or permission of instructor
G (Spring)
5-0-10 H-LEVEL Grad Credit
Unified treatment of phenomenological and atomistic kinetic processes in materials. Provides the foundation for the advanced understanding of processing, microstructural evolution, and behavior for a broad spectrum of materials. Emphasis on analysis and development of rigorous comprehension of fundamentals. Topics include: irreversible thermodynamics; diffusion; nucleation; phase transformations; fluid and heat transport; morphological instabilities; gas-solid, liquid-solid, and solid-solid reactions.
S. M. Allen

3.22 Mechanical Properties of Materials
Prereq: 3.032
G (Spring)
4-0-8 H-LEVEL Grad Credit
Phenomenology of mechanical behavior of materials at the macroscopic level. Relationship of mechanical behavior to material structure and mechanisms of deformation and failure. Topics include: elasticity, viscoelasticity, plasticity, creep, fracture, and fatigue. Case studies and examples drawn from structural and functional applications that include a variety of material classes: metals, ceramics, polymers, thin films, composites, and cellular materials.
Staff

3.225 Electronic and Mechanical Properties of Materials
Prereq: 8.03, 3.032
G (Fall)
4-0-8 H-LEVEL Grad Credit
Electrical, optical, magnetic, and mechanical properties of metals, semiconductors, ceramics and polymers. Discussion of roles of bonding, structure (crystalline, defect, energy band and microstructure) and composition in influencing and controlling physical properties. Case studies drawn from a variety of applications including semiconductor diodes, optical detectors, sensors, thin films, biomaterials, composites, and cellular materials.
L. J. Gibson, E. A. Fitzgerald

3.23 Electrical, Optical, and Magnetic Properties of Materials
Prereq: 8.03, 18.03
G (Fall)
4-0-8 H-LEVEL Grad Credit
Origin of electrical, magnetic and optical properties of materials. Focus on the acquisition of quantum mechanical tools. Analysis of the properties of materials. Presentation of the postulates of quantum mechanics. Examination of the hydrogen atom, simple molecules and bonds, and the behavior of electrons in solids and energy bands. Introduction of the variation principle as a method for the calculation of wavefunctions. Investigation of how and why materials respond to different electrical, magnetic and electromagnetic fields and probes. Study of the conductivity, dielectric function, and magnetic permeability in metals, semiconductors, and insulators. Survey of common devices such as transistors, magnetic storage media, optical fibers.
N. Marzari

3.271 Diffraction and Structure
(Subject meets with 3.073)
Prereq: 18.03, 3.024
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8 H-LEVEL Grad Credit
See description under subject 3.073.
B. J. Wuensch

3.29 Special Problems in Emerging and Fundamental Studies in Materials
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

3.30 Atomistic Computer Modeling of Materials
Prereq: 3.022, 3.20, 3.23 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
G. Ceder

3.34 Imaging of Materials (New)
(Subject meets with 3.074)
Prereq: 3.23 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 3.074. Graduate students complete additional assignments.
S. Gradecek

3.35 Fracture and Fatigue
Prereq: 3.032
Acad Year 2007–2008: Not offered
G (Fall)
3-0-9 H-LEVEL Grad Credit
Linear elastic and elastic-plastic fracture mechanics. Experimental methods. Microstructural effects on fracture in metals, ceramics, polymers, thin films, biological materials and composites. Toughening mechanisms. Crack growth resistance and creep fracture. Interface fracture mechanics. Fatigue damage and

S. Suresh

3.37 Welding and Joining Processes
(Subject meets with 2.821, 3.371)
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
3-0-3 H-LEVEL Grad Credit

Discusses a wide variety of processes and materials from the viewpoint of their fundamental physical and chemical properties. Specific topics: cold welding, adhesive bonding, diffusion bonding, soldering, brazing, flames, arcs, high-energy density heat sources, solidification, cracking resistance, shielding methods, and electric contacts. Emphasis on underlying science of a given process rather than a detailed description of the technique or equipment. Meets with first half of subject 3.371 in Fall Term; videotaped instruction.

T. W. Eagar

3.371 Fabrication Technology
(Same subject as 2.821)
(Subject meets with 3.37)
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
4-0-5 H-LEVEL Grad Credit

Discusses a wide variety of technologies including welding, brazing, soldering, casting, forging and non-destructive testing, especially as related to ship building and heavy fabrication. Emphasis on the underlying science of a given process rather than a detailed description of the technique or equipment. First half of subject meets with subject 3.37 in Fall Term; videotaped instruction.

T. W. Eagar

3.40 Modern Physical Metallurgy
(Same subject as 22.711)
Prereq: 3.14
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Examines how the presence of 1-, 2- and 3-D defects and second phases control the mechanical, electromagnetic and chemical behavior of metals and alloys. Considers point, line and interfacial defects in the context of structural transformations including annealing, spinodal decomposition, nucleation, growth, and particle coarsening. Concentrates on structure-function relationships, and in particular how grain size, interstitial and substitutional solid solutions, and second-phase particles impact mechanical and other properties. Individually relevant case studies illustrate lecture concepts.
K. J. Van Vliet, C. Schuh

3.42 Electronic Materials Design
Prereq: 3.23
G (Fall)
3-0-9 H-LEVEL Grad Credit

Extensive and intensive examination of structure-processing-property correlations for a wide range of materials including metals, semiconductors, dielectrics, and optical materials. Topics covered include: defect equilibria; junction characteristics; photodiodes, light sources and displays; bipolar and field effect transistors; chemical, thermal and mechanical transducers; data storage. Emphasis on materials design in relation to device performance.
H. L. Tuller

3.43 Integrated Microelectronic Devices
(Same subject as 6.720)
Prereq: 6.012 or 3.42
G (Spring)
4-0-8 H-LEVEL Grad Credit

See description under subject 6.720.
J. A. del Alamo, H. L. Tuller

3.44 Materials Processing for Micro- and Nano-Systems
Prereq: 3.205 and 3.225, or 3.20 and 3.21
G (Fall)
3-0-9 H-LEVEL Grad Credit

Processing of bulk, thin film, and nanoscale materials for applications in electronic, magnetic, electromechanical, and photonic devices and microsystems. Topics include growth of bulk, thin-film, nanoscale single crystals via vapor and liquid phase processes; formation, patterning and processing of thin films, with an emphasis on relationships among processing, structure, and properties; and processing of systems of nanoscale materials. Examples from materials processing for applications in high-performance integrated electronic circuits, integrated sensors, and data storage systems.
C. V. Thompson

3.45 Magnetic Materials
Prereq: 3.23
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Foundation topics include magnetostatics, origin of magnetism in materials, magnetic domains and domain walls, magnetic anisotropy, reversible and irreversible magnetization processes; hard and soft magnetic materials and magnetic recording. Special topics are selected from magnetism at nanoscale (thin films, surfaces, particles); amorphous and nanocrystalline magnetic materials; electronic transport in ferromagnets including magnetoresistive, spin-valve and spin-tunnel junction sensors.
R. C. O’Handley

3.46 Photonic Materials and Devices
Prereq: 3.42
G (Spring)
3-0-9 H-LEVEL Grad Credit

L. C. Kimerling

3.47 Processing of Materials on the Nanoscale
Prereq: 3.20 and 3.21, or 3.205 and 3.44
G (Spring)
3-0-9 H-LEVEL Grad Credit

Coverage includes techniques and underlying principles for synthesis and assembly of materials with one or more nanoscale dimensions, in the form of individual molecules, dots, wires, tubes, or sheets. Focuses on materials with applications arising from size-dependent (e.g., electronic, magnetic, photonic, chemical, or mechanical properties. Synthesis via both physical processes (e.g. lithography, physical vapor deposition) and chemical processes (e.g. chemical vapor deposition, growth from liquid and solid solutions) are discussed. Thermodynamically-driven and kinetically-driven self-assembly processes are described as illustrations of fundamental assembly mechanisms. The formation of hierarchical ordered structures by templated self assembly are also discussed. Lectures complemented by case studies given by the instructors and by outside speakers.
C. A. Ross, C. V. Thompson
3.48 Materials and Processes for Microelectromechanical Devices and Systems
(Same subject as 2.373J, 6.778J, 10.584J, 16.288J)
Prereq: 6.152J/3.155J; permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Unified treatment of key principles in materials and processing for design and manufacture of microelectromechanical systems (MEMS). Emphasis on materials and processes commonly used for fabrication for MEMS and not microelectronic systems. Discussion of the processing and properties of both thin and thick polycrystalline and amorphous films, wafer and thin film bonding, bulk micromachining techniques, and the relationships between processing and properties of active materials such as piezoelectrics, ferroelectrics and phase-transition materials. Key material properties and parameters and their relationships with microfabrication processes and applications are discussed, including elastic and inelastic deformation, fracture, residual stress, fatigue, creep, adhesion, stiction, and coupled-field constitutive behavior. Materials and process selection and case studies of applications provide a unifying theme.
L. Anand, K. F. Jensen, M. A. Schmidt, C. V. Thompson, B. L. Wardle

3.49 Special Problems in Electronic, Photonic and Magnetic Materials
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

3.491 Special Problems in Electronic, Photonic and Magnetic Materials
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Advanced work for qualified students. Lectures, conferences, assigned readings, or supervised laboratory work.
Y. Fink

3.52 Advanced Materials Processing
(Same subject as 10.581J)
(Subject meets with 3.048J)
Prereq: 3.022, 3.044
G (Spring)
3-0-9 H-LEVEL Grad Credit
Fundamentals of materials processing. Building engineering structures from the atomic- and nano-scales to macroscopic levels. Case studies illustrating application of processing science to creation of modern metallic, ceramic, polymeric and biomaterials devices and components.
C. Schuh, M. C. Flemings

3.53 Electrochemical Processing of Materials
Prereq: 3.044
G (IAP)
3-0-6 H-LEVEL Grad Credit
D. R. Sadoway

3.54 Corrosion: The Environmental Degradation of Materials
(Same subject as 22.72J)
Prereq: 3.012
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Applies thermodynamics and kinetics of electrode reactions to aqueous corrosion of metals and alloys. Application of advanced computational and modeling techniques to evaluation of materials selection and susceptibility of metal/alloy systems to environmental degradation in aqueous systems. Discusses materials degradation problems in marine environments, oil and gas production, and energy conversion and generation systems, including fossil and nuclear. Offered alternate years.
R. G. Ballinger

3.56 Engineering Systems Analysis for Design
Engineering School-Wide Elective Subject.
(Offered under: 1.146, 3.56, 16.861, ESD.71)
Prereq: 1.145J or permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject ESD.71.
R. de Neufville

3.560J Industrial Ecology
(Same subject as 1.814J, ESD.123J)
Prereq: ESD.10 or 3.56
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject ESD.123J.
R. Kirchain, J. Clark, F. Field

3.57 Materials Selection, Design, and Economics
(Same subject as ESD.73J)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
A survey of techniques for analyzing how the choice of materials, processes, and design determine properties, performance, and cost. Topics include production and cost functions, mathematical optimization, evaluation of single and multi-attribute utility, decision analysis, materials property charts, and performance indices. Students use analytical techniques to develop a plan for starting a new materials-related business.
J. Clark

3.575 Materials Selection, Design, and Economics
(Same subject as ESD.730J)
Prereq: Permission of instructor
G (Summer)
2-0-4 H-LEVEL Grad Credit
See description under subject ESD.730J.
J. P. Clark

3.577 Engineering Risk-Benefit Analysis
Engineering School-Wide Elective Subject.
(Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.72.
G. E. Apostolakis

3.595 Special Problems in Structural and Environmental Materials
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

3.596 Special Problems in Structural and Environmental Materials
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Advanced work in the field for qualified students. Lectures, conferences, assigned readings, or supervised laboratory work.
D. K. Roylance
3.60 Symmetry, Structure, and Tensor Properties of Materials
(Subject meets with 3.072)
Prereq: 3.016 or 18.03
G (Fall)
4-0-8 H-LEVEL Grad Credit

Derivation of symmetry theory; lattices, point groups, space groups, and their properties. Use of symmetry in tensor representation of crystal properties, including anisotropy, representation surfaces, as well as applications to piezoelectricity and elasticity.

B. J. Wuensch

3.63 Ceramic Processes
Prereq: 3.07, 3.20
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit

Presents quantitative treatment of unit operations in powder processing—powder preparation, fabrication, and firing. Discusses glass processing—homogenization during melting: relationship to mixing theory—glass forming. Also covers growth of crystals, thermodynamics, transport processes, and kinetics in relation to structures developed. Offered alternate years.

M. J. Cima

3.691–3.699 Teaching Materials Science and Engineering
Prereq: —
G (Fall, Spring)
Units arranged
Can be repeated for credit

Laboratory, tutorial, or classroom teaching under the supervision of a faculty member. Students selected by interview. Enrollment limited by availability of suitable teaching assignments.

Y. M. Chiang

3.80J Proseminar in Manufacturing
(Same subject as 2.890J, 10.792J, 15.792J, 16.985J)
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

See description under subject 15.792J.

D. B. Rosenfield

3.901 Special Problems in Bio and Polymeric Materials
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

3.902 Special Problems in Bio and Polymeric Materials
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Advanced work in the field. Lectures, conferences, assigned readings, and laboratory work.

C. Ortiz

3.903J Student Seminar in Polymer Science and Technology
(Same subject as 10.960J)
Prereq: —
G (Fall, Spring)
2-0-0 [P/D/F]
Can be repeated for credit

See description under subject 10.960J.

G. H. McKinley, P. S. Doyle, K. Van Vliet, D. Irvine

3.91 Mechanical Behavior of Polymers
Prereq: Introductory subjects in solid mechanics and polymers recommended (e.g. 3.032, 3.034)
G (Spring)
3-0-9 H-LEVEL Grad Credit

Influence of processing and structure on mechanical properties of synthetic and natural polymers: Hookean and entropic elastic deformation, linear viscoelasticity, composite materials and laminates, yield and fracture.

D. K. Roylance

3.930 Industrial Practice
Prereq: —
U (Summer)
0-6-0 [P/D/F]
Provides academic credit for first approved work assignment at a company. For reporting requirements, consult faculty industrial practice coordinator. Enrollment restricted to students in Course 3.

C. A. Ross

3.931 Industrial Practice
Prereq: —
U (Summer)
0-6-0

Enrollment restricted to students in Course 3. Provides academic credit for second approved work assignment at a company in the year following completion of 3.930. For reporting requirements consult faculty industrial practice coordinator.

C. A. Ross

3.932 Industrial Practice
Prereq: Permission of instructor
G (Fall, Spring, Summer)
0-6-0 H-LEVEL Grad Credit
Can be repeated for credit

Provides academic credit for graduate students in Course 3B for approved work assignments at companies.

S. M. Allen

3.94 Morphology of Polymers
Prereq: 3.063
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6

Structure of noncrystalline, crystalline, and liquid crystalline polymers, including polymers blends, and block copolymers. Texture development from processing operations, mechanical deformation, and applied electric and magnetic fields. Hybrid organic-inorganic nano and microcomposites. Phase transformations, including classical nucleation theory and spinodal decomposition. Use of morphological characterization methods such as wide- and small-angle x-ray scattering and scanning, transmission electron microscopy and atomic force microscopy are also covered. Alternate years.

E. L. Thomas

3.941J Statistical Mechanics of Polymers
(Same subject as 10.668J)
Prereq: 10.568 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 10.668J.

G. C. Rutledge, A. Mayes

3.96J Biomaterials: Tissue Interactions
(Same subject as 2.79J, 20.441J, HST.522J)
Prereq: 3.091; 5.111 or 5.112; 2.005 or 5.60; 7.012 or 7.013
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 20.441J.

I. V. Yannas, M. Spector
3.961 Design of Medical Devices and Implants  
(Same subject as 2.782), 20.451 J, HST.524 J)  
Prereq: 2.79 J or permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 2.782).  
I. V. Yannas, M. Spector

3.962 Molecular Principles of Biomaterials  
(Same subject as 20.462 J)  
Prereq: Permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 20.462 J.  
D. J. Irvine

3.97 Cell-Matrix Mechanics  
(Same subject as 2.785 J, 20.411 J, HST.523 J)  
Prereq: 3.091, 5.11, 5.111, or 5.112; 2.005 or 5.60; 7.012, 7.013, 7.014, or 7.015  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 2.785 J.  
I. V. Yannas, M. Spector

3.971 Molecular, Cellular, and Tissue Biomechanics  
(Same subject as 2.798 J, 6.524 J, 10.537 J,  
20.410 J)  
Prereq: 7.012; 2.002, 2.006, 6.013, 6.014,  
10.301, or 10.302  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 20.410 J.  
A. J. Grodzinsky, P. Doyle, S. Suresh

3.98 Polymer Synthetic Chemistry  
Prereq: any basic polymer chemistry subject  
G (Spring)  
3-0-6 H-LEVEL Grad Credit  
An examination of the fundamental reaction  
mechanisms and chemistry of polymerization  
reactions with an emphasis on the synthesis of  
new advanced polymers and their properties.  
M. F. Rubner

ARCHAEOLOGY AND ARCHAEOLOGICAL SCIENCE

3.982 The Ancient Andean World  
Prereq: —  
U (Fall)  
3-0-6 HASS  
Examines development of Andean civilization  
which culminated in the extraordinary em-  
pire established by the Inka. Archaeological,  
ethnographic, and ethnohistorical approaches.  
Particular attention to the unusual topography  
of the Andean area, its influence upon local  
ecol., and the characteristic social, political,  
and technological responses of Andean people to life  
in a topographically “vertical” world. Character-  
cistic cultural styles of prehistoric Andean life.  
H. N. Lechman

3.983 Ancient Mesoamerican Civilization  
Prereq: —  
U (Spring)  
3-0-6 HASS  
Examines origins, florescence and collapse of  
selected civilizations of ancient Mesoamerica  
using archaeological and ethnohistorical evidence.  
Focus on Olmec, Maya, Teotihuacan and Aztec,  
considering key technological, environmental,  
social organizational and ideological variables.  
Investigates contacts between South America  
and Western Mexico.  
D. Hosler

3.984 Materials in Ancient Societies: Metals  
Prereq: Permission of instructor  
G (Fall)  
3-6-3  
Seminars and labs provide in-depth study of the  
technologies ancient societies used to produce  
metal objects from native and smelted metals.  
Seminars cover basic physical metallurgy and re-  
late materials selection and processing to envi-  
rionment, exchange, aesthetics, political power,  
and cultural values. Senior undergraduates may  
register for subject under special topics number:  
consult instructor.  
H. N. Lechman, D. Hosler

3.985 Archaeological Science  
(Same subject as 5.24 J, 12.011 J)  
Prereq: 3.091, 5.111, 5.111, 5.112, or 8.01  
U (Spring)  
3-1-5 HASS  
Pressing issues in archaeology as an anthro-  
pological science. Stresses the natural science  
and engineering methods archaeologists use  
to address these issues. Reconstructing time,  
space, and human ecologies provides one focus;  
materials technologies that transform natural  
materials to material culture provide another.  
Topics include 14C dating, ice core and palyno-  
logical analysis, GIS and other remote sensing  
techniques for site location, soil micromor-  
phology and site formation, sourcing of metal  
artifacts, and microstructural and mechanical  
analyses of cementitious materials used in  
an ancient monumental buildings.  
H. N. Lechman, J. Stubbe, F. A. Frey

3.986 The Human Past: Introduction to  
Archaeology  
Prereq: —  
U (Fall)  
3-2-7 HASS-D, Category 4  
Archaeology reconstructs ancient human activi-  
ties and their environmental contexts. Examines  
these activities and the forces that shaped them,  
drawing on case studies in contrasting environ-  
mental settings from the Near East and Meso-  
america. In laboratory sessions, students learn  
to manage various classes of archaeological data  
and analyze archaeological artifacts made from  
materials such as stone, bone, and ceramics.  
These analyses help reconstruct the past.  
H. V. Merrick

3.987 Human Origins and Evolution  
Prereq: —  
U (Spring)  
3-0-6 HASS  
Examines the dynamic interrelations among  
physical and behavioral traits of humans and  
environment and culture to provide an integrated  
framework for studying human biological evolu-  
tion and modern diversity. Topics include issues  
in morphology evolution and adaptation;  
fossil and cultural evidence for human evolution  
from earliest times through the Pleistocene; evo-  
luion of tool use and social behavior; modern  
human variation and concepts of race. Includes  
study of stone artifacts and fossil specimens.  
H. V. Merrick

3.988 Africa—Past and Present: An  
Archaeological and Ethnographic Materials  
Perspective  
Prereq: —  
Acad Year 2007–2008: U (Spring)  
Acad Year 2008–2009: Not offered  
3-0-6 HASS  
Examines prehistory and modern ethnographic  
diversity of technology on the African continent,  
with particular emphasis on the sub-Saharan  
region. Traces the course of human technologi-  
cal evolution from the earliest Plo-Pleistocene  
tool-making hominids to the modern ethnically  
diverse inhabitants of the continent, by way of  
topical case studies. These cases are centered  
on subsistence adaptations and technologi-  
cal responses. Includes lectures, experience  
handling prehistoric stone artifacts and modern  
ethnographic items, and ethnographic films.  
H. V. Merrick
3.989 Materials in Ancient Societies: Metals Laboratory
Prereq: Permission of instructor
G (Spring)
3-6-3
Laboratory analysis of archaeological artifacts of metal. Follows on 3.984.
H. N. Lechtman, D. Hosler

3.990 Seminar in Archaeological Method and Theory
Prereq: 3.986, 3.985J, 21A.100
U (Fall, Spring)
2-0-4
Designed for undergraduate seniors majoring in Archaeology and Materials. Critical analysis of major intellectual and methodological developments in American archaeology, including evolutionary theory, the “New Archaeology,” Marxism, formal and ideological approaches. Explores the use of science and engineering methods to reconstruct cultural patterns from archaeological data. Seminar format, with formal presentations by all students. Non-majors fulfilling all prerequisites may enroll by permission of instructors. Instruction and practice in oral and written communication provided.
D. Hosler, H. Lechtman, H. Merrick

3.993 Archaeology of the Middle East
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-6 HASS
Focus on the rise of settled communities, cities, and empires and their technological achievements in various areas of the Middle East including Anatolia, the Levant, and Mesopotamia. Using archaeological and written sources, examines why such complex societies arose in this area. Considers the technological basis of these societies; the role of temples and religious hierarchies, of crafts and trade in luxury goods, of writing and bureaucracies, and of class stratification in the rise of early civilizations.
H. Merrick

3.997 Graduate Fieldwork in Materials Science and Engineering
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of field research in materials science and engineering leading to the writing of an SM, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member.
D. Hosler, H. Lechtman

3.EPE UPOP Summer Practice Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPE, 2.EPE, 3.EPE, 10.EPE, 16.EPE, 22.EPE)
Prereq: 2.EPW or permission of instructor
U (Fall, Spring)
0-1-0 [P/D/F]
Can be repeated for credit
See description under subject 2.EPE.
D. K. R. Yue

3.EPR UPOP Reflective Learning Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPR, 2.EPR, 3.EPR, 10.EPR, 16.EPR, 22.EPR)
Prereq: 2.EPE or permission of instructor
U (Fall)
0-0-3 [P/D/F]
See description under subject 2.EPR.
D. K. R. Yue

3.EPW UPOP IAP Workshop
Engineering School-Wide Elective Subject.
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW, 10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]
See description under subject 2.EPW.
D. K. R. Yue

3.ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of an SM, MEng, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member.
S. M. Allen

3.ThU Undergraduate Thesis
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Program of research leading to the writing of an SB thesis; to be arranged by the student and an appropriate MIT faculty member. Instruction and practice in oral and written communication.
Consult C. A. Ross

3.URG Undergraduate Research
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Extended participation in work of a research group. Independent study of literature, direct involvement in group’s research (commensurate with student skills), and project work under an individual faculty member. See UROP coordinator for registration procedures.
B. J. Wuensch
4.001 CityScope
(Same subject as 11.004)
Prereq: —
U (Spring)
3-0-9 HASS
Project-based introduction to the contemporary city as a complex system within a context of limited resources and competing interests. Learn to assess scenarios for the purpose of formulating social, economic and design strategies that provide optimized solutions that are humane and sustainable. Group projects develop and advocate visions for housing, urban planning, regeneration of natural ecologies and other sectors of the city. During spring break the class visits New Orleans, the focus of Cityscope in 2007. This trip is funded, and not required. Includes exercises in written and oral communication and team building. Limited to 15 participants. Preference to freshmen.
J. Fernandez, P. Thompson

4.102 Drawing for Architects
Prereq: 4.101
U (IAP)
0-3-0 [P/D/F]
Focuses on drawing from observation and explores a range of non-digital media. Exercises use still life arrangements as well as the human figure, and includes gesture drawing, composition and interior perspective. Charcoal, oil pastel, India ink and acrylic paint used to develop a broad range of drawing techniques that can be applied to design studio work. Enrollment limited to 15 students.
Architecture Design Staff

4.106 Architectural Design Skills II
Prereq: 4.105
G (Spring)
2-2-8
Focuses on representation tools used by architects during the design process and attempts to discuss the relationship they develop with the object of design. Teaches how to translate an intensity to its concrete version, through the use of representation devices. Subject spans two semesters and establishes a reciprocal relationship with the design studio. In the fall semester, students focus on manual representation tools, such as graphic layouts, physical model making, drafting of architectural plans, sections and perspectives. In the spring semester, students focus on digital media, which has redefined the design process. Required of and restricted to level one MArch students.
Architecture Design Staff

4.108 BSAD Portfolio Workshop
Prereq: 4.104 or 4.113
U (Fall)
2-0-1
Covers the skills needed to design a successful portfolio that can be used to apply for internships and graduate study. Topics include design aesthetics, graphics, book assemblage, binding techniques, and various computer applications. Limited to Course 4 majors and minors.
Architecture Design Staff

4.111 Experiencing Architecture Studio
(4.101)
Prereq: —
U (Fall, Spring)
3-3-6
Uses scale models to design environments that orchestrate contrasting material properties and conventional constructional systems to create places that foster specific ways of inhabiting space. Demonstrates how architecture differs from other forms of design. Intended for students to test aptitude for architectural design and to experience an unfamiliar mode of thought. Conducted in a studio format, with lectures on architectural theory and history, and structured for students with no previous experience in design. Required of Course 4 majors.
B. Hubbard

4.112 Integrated Architecture Design Studio
(New)
Prereq: 4.111
U (Fall)
3-3-6
Second undergraduate design studio. Design within the context of structures, building technology, visual arts, computation and architectural history through several short design projects. Develop and present design solutions through the use of models, drawings, sketching and 3-D computer modeling. Studio format with a combination of lectures and guided work.
Architecture Design Staff

4.113 Applied Architecture Design Studio I
(4.104)
Prereq: 4.101 or 4.111
U (Spring)
3-6-6
Third undergraduate design studio. Introduces a full range of architectural ideas and issues through drawing exercises, sketch models, analysis of precedents, and explored design methods. Skills developed in conceptualizing, articulating, and representing architectural ideas and making aesthetic judgments about building design. Discussions regarding architecture’s role in mediating culture, nature, and technology help develop architectural vocabulary. Special emphasis on both oral and written communication skills is intended to help students effectively convey design concepts. Open to sophomores, juniors, and seniors only. Preference to Course 4 majors and minors.
Architecture Design Staff
4.114 Applied Architecture Design Studio II
(4.125)
Prereq: 4.104 or 4.113; 4.302, 4.401, 4.500, 4.605
U (Fall)
0-12-9
Fourth undergraduate design studio. Learn to build appropriately through analysis of landscape and climate for a chosen site. Conceptualize design decisions through drawings and models. Preference to Course 4 majors and minors. Mandatory lottery.
J. Wampler, Architecture Design Staff

4.115 Applied Architecture Design Studio III
(4.126)
Prereq: 4.114
U (Spring)
0-12-9
Fifth undergraduate design studio. Introduces skills needed to build within contemporary cities, extending from the historical center to expanding edges. Analyze an existing environment and design a built structure that fosters relationships between its intended activities and the larger urban territory and redefines the urban environment. Design project emphasizes issues of housing. Preference to Course 4 majors. Mandatory lottery.
Architectural Design Staff

4.116 Advanced Architecture Design Studio
(4.131)
Prereq: 4.115, 4.440
U (Fall)
0-12-9
Sixth undergraduate design studio. Projects develop the design skills and the experience of both theoretical and pragmatic issues facing the architect. Focus on how architecture creates environments for living, working, and learning in varied settings and with complex programmatic needs in an international setting. Integrates environmental and climatic concerns, structure and constructional parameters. Preference to Course 4 majors. Mandatory lottery.
Architectural Design Staff

4.119 Preparation for Undergraduate Architecture Design Thesis (New)
Prereq: —
U (Fall)
1-0-2
Selection of thesis topic, defining method of approach, and preparation of thesis proposal for BSAD degree in architecture design. Weekly class meeting as well as individual conference with faculty.
J. Wampler

4.122 Workshop in Making and Designing Space (New)
Prereq: 4.111
U (Spring)
0-6-0
The process of making and building is an integral part of designing. Study space design through material exploration and building techniques. Interactive architecture design workshop to help understand the logistics of building and designing. Study different kinds of spaces and build a design project by joining wood, forging and welding steel, and casting concrete.
C. Dewart, J. Wampler

4.12A Integrated Architecture Design Intensive Studio (New)
Prereq: 4.111
U (IAP)
3-3-3
Second undergraduate design studio. Design within the context of structures, building technology, visual arts, computation and architectural history through several short design projects. Develop and present design solutions through the use of models, drawings, sketching and 3-D computer modeling. Studio format with a combination of lectures and guided work.
Architectural Design Staff

4.123, 4.124 Architectural Design: Level I
Prereq: Permission of instructor
G (Fall, Spring)
0-12-9 H-LEVEL Grad Credit
Can be repeated for credit
Establishes basic attitudes toward architectural organization and its reflection in form. Includes projects where imposed conditions of site, program, and building system emphasize the interrelationship of fundamental elements in the pattern of decision making that constitutes architectural design. Develops presentations through drawings and models. Intended for entering MArch students. Must be taken in sequence.
Architectural Design Staff

4.143, 4.144 Architectural Design: Level II
Prereq: 4.124 or 4.126
G (Fall, Spring)
0-12-9 H-LEVEL Grad Credit
Can be repeated for credit
Projects develop the design skills and the experience of both theoretical and pragmatic issues facing the architect. Fall term studios focus on learning about the material and tectonic aspects of architectural production, especially as they influence the generative ideas of form. Spring studios center upon learning how architecture creates environments for living, working, and learning in varied settings and with complex programmatic needs. Both terms integrate environmental and climatic concerns, structure and constructional parameters. Students must choose design studio through a lottery process.
Architectural Design Staff

4.155, 4.156 Architectural Design: Level III
Prereq: 4.144
G (Fall, Spring)
0-12-9 H-LEVEL Grad Credit
Can be repeated for credit
Emphasizes setting of architectural work as part of an organized community in projects having to do with built-up areas, as well as those on new sites. Studies plan for long-range development, giving students increasing experience in the analysis of real-life situations requiring program research. Students must choose design studio through a lottery process.
Architectural Design Staff

4.163] Urban Design Studio
(Same subject as 11.332)
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
The design of urban environments. Strategies for change in large areas of cities, to be developed over time, involving different actors. Fitting forms into natural, man-made, historical, and cultural contexts; enabling desirable activity patterns; conceptualizing built form; providing infrastructure and service systems; guiding the sensory character of development. Involves architecture and planning students in joint work; requires individual designs or design and planning guidelines.
J. Beinart, J. P. de Monchaux, M. Dennis, A. D’Hooghe

4.166 Beijing Studio
Prereq: 4.144
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
A design and development studio involving architects and planners working in teams on a contemporary design project of importance.
in Beijing, China. Enrollment limited to 10 students.

J. Wampler, D. Frenchman, Y. H. Chang

4.170 International Architecture Design Workshop
Prereq: Permission of instructor
U (Fall) 3-2-4
Can be repeated for credit

Interactive design research in developing areas outside the US. Students assist in drawing, modeling and constructing small buildings appropriate for the culture, climate, and specific population under consideration.

J. Wampler

4.171 The Space Between Workshop
Prereq: Permission of instructor
G (Spring) 3-2-4 H-LEVEL Grad Credit
Can be repeated for credit

Architectural design workshop focusing on understanding and designing the space between objects as well as the the space within objects.

J. Wampler

4.175 Case Studies in City Form
Prereq: Permission of instructor
G (Fall) 0-6-6 H-LEVEL Grad Credit

Introduction to urban form and design, focusing on the physical, historical, and social form of cities. Selected cities are analyzed, drawn, and compared, to develop a working understanding of urban and architectural form. The development of mapmaking and urban representation is discussed, and use of the computer is required. Special focus on the historical development of the selected cities, especially mid-19th and mid-20th century periods of expansion. Readings on urban design theory in the 20th century and a weekly discussion/seminar on them. Methods class for SMArchS students in Architecture and Urbanism.

M. Dennis

4.180 Architectural Design Workshop
Prereq: 4.113 or permission of instructor
U (Fall, Spring) Units arranged
Can be repeated for credit

4.181–4.185 Architectural Design Workshops
Prereq: 4.115, 4.143 or permission of instructor
G (Fall, Spring) Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Subject in design inquiry taught in studio format treating selected issues of the built world in depth. The problem may be prototypical or a particular aspect of a whole project, but always interdisciplinary in nature.

Architectural Design Staff

4.189 Preparation for MArch Thesis
Prereq: Permission of instructor
G (Fall, Spring) 3-1-5 H-LEVEL Grad Credit

Analytical review of previous work leading to a proposition for thesis topic, definition of method of approach, and preparation of thesis proposal. Students explore methods of thinking about and representing the work. Through a critical assessment of their existing portfolio, students are challenged to articulate design theses and interests in past projects. Group study supplemented by individual conference with faculty. Required of and restricted to MArch students.

A. Dutta

4.191, 4.192 Special Problems in Architectural Design
Prereq: Permission of instructor
U (Fall, Spring) Units arranged
Can be repeated for credit

4.194 Special Problems in Architectural Design
Prereq: Permission of instructor
U (Fall, Spring) Units arranged [P/D/F]
Can be repeated for credit

4.195, 4.196 Special Problems in Architectural Design
Prereq: Permission of instructor
G (Fall, Spring) Units arranged H-LEVEL Grad Credit
Can be repeated for credit

4.199 Special Problems in Architectural Design
Prereq: Permission of instructor
G (Fall, Spring) Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.

M. Dennis, A. D’Hooghe, R. Goethert

4.211J The Once and Future City
(Same subject as 11.016J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring) 3-0-9 HASS, CI-H
See description under subject 11.016J.

A. Spirn

(Same subject as 11.308J)
Prereq: Permission of instructor
G (Fall) 3-0-9 H-LEVEL Grad Credit
See description under subject 11.308J.

A. Spirn

4.215] Sites in Sight: Photographing the Urban Landscape
(Same subject as 11.309J)
Prereq: —
G (Fall) 3-0-9
See description under subject 11.309J.

A. Spirn

4.218, 4.219 Special Problems in Urban Housing
Prereq: Permission of instructor
G (Fall, Spring) Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.

M. Dennis, A. D’Hooghe, R. Goethert

Prereq: Permission of instructor
G (Fall) 3-0-6 H-LEVEL Grad Credit
Can be repeated for credit


M. Dennis

4.221 Architecture Studies Faculty Colloquium
Prereq: Permission of instructor
G (Fall) 2-0-1

Required subject for all first-year SMArchS students. Presentations by departmental faculty on a theme derived from their research or practice followed by discussion. Requirements include active student participation and a final paper reviewing the theoretical issues raised by the
colloquium presentations in the context of the research topic of the student.

Staff

4.222 Professional Practice
Prereq: Permission of instructor
G (Fall)
3-0-3 H-LEVEL Grad Credit
Gives a critical orientation toward a career in architectural practice. Uses historical and current examples to illustrate the legal and ethical concepts underlying present practice, and from them, to trace the possible trajectories of future practice. Required of MArch students.

B. Hubbard

4.231 Special Interest Group in Urban Settlements: SIGUS Workshops
(Same subject as 11.465J)
Prereq: Permission of instructor
G (IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

4.230 SIGUS Workshop: Learning from Communities
(Same subject as 11.468J)
Prereq: Permission of instructor
G (IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Interactive, interdisciplinary workshops that focus on projects and practices on urban settlement issues in developing countries throughout the world. Participation by guest practitioners.

R. Goethert

4.235 Sustainable Settlement Design in Developing Countries
Prereq: Permission of instructor
G (IAP, Spring)
Units arranged H-LEVEL Grad Credit
Explores physical planning issues in low-income housing developments. Topics structured around measurement, modeling and prediction of design interventions, using evaluation as an entry to understanding good practice.

R. Goethert

4.236 Structuring Low-Income Housing Projects in Developing Countries
(Same subject as 11.463J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Examines dynamic relationship among key actors: beneficiaries, government, and funder. Emphasis on cost recovery, affordability, replicability, user selection, and project administration. Extensive case examples provide basis for comparisons.

R. Goethert

4.237 The New Practitioner: Dialogue Tools and Techniques
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Explores a new paradigm of practice that considers dialogue essential for efficacious and creative design process. Focus on non-traditional client groups: communities, the poor, and the generally excluded middle-income. Stress on exercises and extensive field visits. Supplemented with background readings and presentations by invited professionals.

R. Goethert

4.238 Sustainable Settlement Design in Developing Countries
Prereq: Permission of instructor
G (IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Examines new paradigm of practice that considers dialogue essential for efficacious and creative design process. Focus on non-traditional client groups: communities, the poor, and the generally excluded middle-income. Stress on exercises and extensive field visits. Supplemented with background readings and presentations by invited professionals.

R. Goethert

4.239 Media Technology and City Design and Development
(Same subject as 11.310J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9
See description under subject 11.310J.

A. Spinn, C. McDowell

4.240 Urban Design Seminar
(Same subject as 11.333J)
Prereq: —
G (Spring)
2-0-7
See description under subject 11.333J.

D. Frenchman, S. Silberberg

4.241 Theory of City Form
(Same subject as 11.330J)
Prereq: 11.001J, 4.252J, or 11.301J
G (Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Theories about the form that settlements should take. Attempts a distinction between descriptive and normative theory by examining examples of various theories of city form over time. Concentrates on the origins of the modern city and theories about its emerging form, including the transformation of the 19th century city and its organization. Analyzes current issues of city form in relation to city-making, social structure, and physical design.

J. Beinart

4.242 Advanced Seminar in City Form
(Same subject as 11.331J)
Prereq: 4.241J or 11.330J
G (Fall)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Examines in greater depth themes from the basic subject in city form theory. Introduces new concepts from current research and practice for analysis by the seminar participants. Required of professional practice. Required of MArch students.

J. Beinart

4.244 Urban Design Policy and Action
(Same subject as 11.337J)
Prereq: 11.301J
G (Spring)
2-0-7 H-LEVEL Grad Credit
See description under subject 11.337J.

J. Beinart, M. Dennis, A. D’Hooghe

4.245 Real Estate Development I
(Same subject as 11.349J)
Prereq: —
G (Fall, Spring)
6-6-15
See description under subject 11.349J.

T. Ciocchetti, L. Fisher

4.246 Real Estate Development I
(Same subject as 11.349J)
Prereq: —
G (Fall, Spring)
6-6-15
See description under subject 11.349J.

T. Ciocchetti, L. Fisher

4.247 Urban Design Policy and Action
(Same subject as 11.337J)
Prereq: 11.301J
G (Spring)
2-0-7 H-LEVEL Grad Credit
See description under subject 11.337J.

J. M. Schuster

4.248, 4.249 Special Problems in City Form
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.

J. Beinart, M. Dennis, A. D’Hooghe
4.250 Introduction to Urban Design and Development
(Same subject as 11.001J)
Prereq: —
U (Fall)
3-0-9 HASS
See description under subject 11.001J.
Staff

4.252 Introduction to Urban Design and Development
(Same subject as 11.301J)
Prereq: Permission of instructor
G (Fall)
3-0-9
See description under subject 11.301J.
D. Frenchman

4.253 Urban Design Politics
(Same subject as 11.302J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 11.302J.
L. Vale

4.254 Real Estate Development II
(Same subject as 11.303J)
Prereq: Permission of instructor
G (Spring)
6-0-9 H-LEVEL Grad Credit
See description under subject 11.303J.
D. Frenchman, P. Roth

4.255 Site and Urban Systems Planning
(Same subject as 11.304J)
Prereq: Permission of instructor
G (Spring)
2-2-8
See description under subject 11.304J.
E. Ben-Joseph

4.257 Property Rights under Transition
(Same subject as 11.467J, 17.550J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 11.467J.
A. M. Kim

4.259 Special Problems in Urban Design
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.
J. Beinart, M. Dennis, A. D’Hooghe

4.262 Ideal Forms of Contemporary Urbanism
(Same subject as 11.311J)
Prereq: 4.645, 4.241J, 11.330J or permission of instructor
G (Fall)
Units arranged H-LEVEL Grad Credit
Advanced seminar about an architectural approach to the problems of disurbanization. Focuses on texts and projects of a particular lineage of architects and planners, who are pursuing ‘metropolitan urbanity’ through a series of concrete, discrete, tangible interventions from 1944 to 1999. Studies the organization of flows and the articulation of public spaces within various projects seeking a definition of “urbanity” using analytical diagrams. Relates this architectural definition to more theoretical definitions in philosophy and anthropology.
A. D’Hooghe

4.280 Undergraduate Architecture Internship
Prereq: 4.125
U (IAP)
0-0-6 [P/D/F]
Can be repeated for credit
Work in an architect’s office to gain experience, improve skills, and see the inner workings of an everyday architectural practice. Internships in all sizes of firms and in public and nonprofit agencies. Internships require full-time work for the entire IAP.
J. Fernandez

4.287 Graduate Architecture Internship
Prereq: 4.123
G (IAP)
0-0-6 [P/D/F]
Can be repeated for credit
Work in an architect’s office to gain experience, improve skills, and see the inner workings of an everyday architectural practice. Internships in all sizes of firms and in public and nonprofit agencies. Internships require full-time work for the entire IAP.
J. Fernandez

4.288 Preparation for SMArchS Thesis
Prereq: 4.221 or permission of instructor
G (Spring)
3-0-6 [P/D/F] H-LEVEL Grad Credit
Architecture Studies Staff

4.290 SMArchS Pre-Thesis Preparation
Prereq: 4.221 or permission of instructor
G (Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Preliminary research in preparation for thesis. Intended for second term SMArchS program students prior to registration for subject 4.288.
Staff

4.285, 4.286 Research Topics in Architecture Studies
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Individual or group research. Registration subject to prior arrangement for subject matter and supervision by staff.
Staff
4.291 Special Problems in Architecture Studies  
Prereq: Permission of instructor  
U (Fall, Spring)  
Units arranged  
Can be repeated for credit

4.292, 4.293 Special Problems in Architecture Studies  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit

4.294 Special Problems in Architecture Studies  
Prereq: Permission of instructor  
U (Fall, Spring)  
Units arranged [P/D/F]  
Can be repeated for credit

4.295–4.297 Special Problems in Architecture Studies  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit

4.302 Introduction to Sculpture  
Prereq: —  
U (Fall)  
2-4-6  
Credit cannot also be received for 4.301  
Can be repeated for credit

4.303 The Production of Space: Art, Architecture, and Urbanism in Dialogue  
Prereq: —  
G (Fall)  
3-3-3  
Subject engages dialogue in architecture and urbanism from the perspective of the artistic field. Ideas investigated thematically from the early modernist practices to recent examples of contemporary production. Examples of artistic practice are examined along with architectural and urban approaches. Focus on interventions by practitioners who intertwine the three disciplines. Texts on the production of space will provide theoretical background. Lectures, readings and discussions lead to the development and realization of group and individual projects coordinated with architectural studio.

U. M. Bauer

4.305 Advanced Visual Arts Studio (Subject meets with 4.306)  
Prereq: Any three Visual Arts Program classes  
U (Spring)  
3-3-6 HASS

4.306 Advanced Visual Arts Studio (New) (Subject meets with 4.305)  
Prereq: Permission of instructor  
G (Spring)  
3-3-6 H-LEVEL Grad Credit  
Focuses on the individual student/artist and the development of a unique body of work. Visual materials, readings, and discussion of the students’ work. Reviews help students critique their work and the work of classmates. Possible media include sculpture, installation, performance, photography, and video. Concludes with a public exhibition.

W. Jacob

4.322 Introduction to Sculpture  
Prereq: —  
U (Fall)  
2-4-6 HASS  
Introduces fundamental issues in sculpture such as site, context, process, and the object’s relation to the body. Explores issues of interpretation and audience interaction. Introduces a variety of materials and techniques including metal, wood, plaster. Lab fee. Limited enrollment.

J. Gibbons

4.341 Introduction to Photography and Related Media  
Prereq: —  
U (Fall, Spring)  
3-3-6 HASS

Combines practical instruction, field trips, group discussions, and individual reviews intended to foster a critical awareness of how images in our diverse culture are constructed, produced and preserved. Student-initiated term projects are at the core of this exploration of the relationship of image to language and issues of interpretation and personal history. Practical instruction in basic black and white techniques, digital imaging, fundamentals of camera operation, lighting, film exposure, development, and printing. 4.343 provides opportunity for continued exploration. Lab fee. Limited enrollment.

A. Frank

4.343 Photography and Related Media  
Prereq: Permission of instructor  
G (Fall, Spring)  
3-0-6  
Can be repeated for credit

Practical instruction, readings, lectures, field trips, visiting artists, group discussions, and individual reviews. Fosters a critical awareness of how images in our diverse culture are constructed, produced and preserved. Student-initiated term project at the core of exploration. Special consideration given to the relationship of space and the photographic image. Practical instruction in basic black and white techniques, digital imaging, fundamentals of camera operation, lighting, film exposure, development, and printing. Open to beginning and advanced students. Lab fee. Enrollment limited, with preference given to current MArch students.

A. Frank

4.351 Introduction to Video  
Prereq: —  
U (Fall, Spring)  
2-4-6 HASS

Introduction to video recording and editing, presenting video as a tool of personal apprehension and expression, with an emphasis on self-exploration, performance, social critique, and the organization of raw experience into aesthetic form (narrative, abstract, documentary, essay). Enrollment limited to 12.

J. Gibbons
4.352 Advanced Video (New)  
(Subject meets with 4.353)  
Prereq: 4.351 or permission of instructor  
U (Fall, Spring)  
2-4-6 HASS  
4.353 Advanced Video (New)  
(Subject meets with 4.352)  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  

Introduction to advanced strategies of image/sound manipulation, both technical and conceptual. Pre-production planning (storyboards, scripting), refinement of digital editing techniques, visual effects such as chroma-keying, and post-production and audio are covered. Context provided by regular views of contemporary video artworks. Additional work required of graduate students. Enrollment in each subject is limited to 12.  

J. Gibbons

4.360 Performance Workshop  
Prereq: Permission of instructor  
G (Spring)  
3-3-6 H-LEVEL Grad Credit  
Can be repeated for credit  

Performance is considered in relation to the media and to spatial structures imagined as settings for narrative movements. Students are asked to consider particular subjects or narratives to work with as source material for experiments in the transforming of an idea into visual form. Video functions as a basic tool while questions of reception in relation to sound and image and how they are altered by various devices are explored. Students make props or objects that embody aspects of their narratives to use in relation to movement and space. Assignments during the workshops lead to a final performance project.  

Visual Arts Staff

4.365 Advanced Projects in Visual Arts (New)  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  

4.366 Advanced Projects in Visual Arts  
Prereq: Permission of instructor  
U (Fall, Spring)  
2-4-6 HASS  
Can be repeated for credit  

Investigates conceptual and formal issues in different media or between media such as sculpture, photography, and video. Explores issues of representation, interpretation, and meaning, and how they relate to historical, social, and cultural context.  

Visual Arts Staff

4.367 Studio Seminar in Public Art  
(Subject meets with 4.368)  
Prereq: Permission of instructor  
G (Spring)  
3-3-6 H-LEVEL Grad Credit  

4.368 Studio Seminar in Public Art (New)  
(Subject meets with 4.367)  
Prereq: Permission of instructor  
U (Spring)  
3-3-6 HASS  

Focuses on the production of visual art for public places outside the gallery/museum context. Readings and discussions that engage aesthetic, social, political, and urban issues relevant to this expanded public context complement studio production. Traditional approaches of enhancement and commemoration are contrasted to more temporal and critical methodologies. Historical models are studied and discussed, including Russian Constructivist experiments, the Situationists, Conceptual Art, and more recent interventionist tactics. Additional work required of graduate students.  

Visual Arts Staff

4.370 Interrogative Design Workshop  
(Subject meets with 4.371)  
Prereq: Permission of instructor  
G (Fall, Spring)  
3-3-6 H-LEVEL Grad Credit  
Can be repeated for credit  

4.371 Interrogative Design Workshop (New)  
(Subject meets with 4.370)  
Prereq: Permission of instructor  
U (Fall, Spring)  
3-3-6  

Can design for needs produced by unacceptable conditions create new critical consciousness to render those needs obsolete? In hope of finding a positive answer, this design workshop responds to needs that should not, but unfortunately do, exist in today's troubled world. Addresses design media and technology as both ethical and aesthetic practice. Development of projects finalized as working tools, instruments, implements, and equipment are supported by relevant theoretical study, presentations and informed discussion. Workshop poses new questions, exposes hidden issues, and creates inspirational and experimental situations for designers and artists as cultural agents.  

K. Wodiczko

4.381 Advanced Visual Design  
Prereq: —  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  

Individual concepts, projects, design, and execution of installations, objects, and events in environmental art and performance involving elemental and science-technology means and media.  

Staff

4.388 Preparation for SMVisS Thesis  
Prereq: Permission of instructor  
G (Spring)  
3-0-6 H-LEVEL Grad Credit  


Visual Arts Staff

4.389 SMVisS Thesis Tutorial (New)  
Prereq: 4.388  
G (Fall, Spring)  
3-0-6 H-LEVEL Grad Credit  

Regularly scheduled presentations and critique by thesis class. Independent thesis research supplemented by individual conference with thesis advisor. Required of SMVisS students. Prerequisite for 4.390.  

Visual Arts Staff

4.390 Visual Arts Independent Studio  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  

Individual inquiry into art relating independent study project to the general direction of student's work and course of study. Consultations with faculty advisor as well as periodic presentations to entire visual arts faculty and guest critics. Required of and restricted to SMVisS program students.  

Visual Arts Staff
4.391–4.393 Special Problems in Visual Arts
Prereq: 4.301
U (Fall, Spring)
Units arranged
Can be repeated for credit

4.394 Special Problems in Visual Arts
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

4.395–4.397 Special Problems in Visual Arts
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

4.398, 4.399 Special Problems in Visual Arts
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.
Visual Arts Staff

4.401 Introduction to Building Technology
Prereq: —
U (Spring)
3-2-7
Introduction to the physical process behind the design of a building’s envelope, interior, and equipment. Integration of technological constraints in architectural design: Response to climate, construction methods and issues, heat and air flow, thermal comfort and insulation, passive and active heating and cooling, natural and electric lighting, visual comfort, acoustics. M. Andersen

4.406 Ecologies of Construction
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Examines the material and energy networks currently utilized to transfer resources from the natural world to the built environment. Theories and tools of industrial ecology are used to reveal opportunities for creating ecologies of construction; that is, mutually beneficial relationships between distinct components of the industry of construction that may be made to act symbiotically. Both the production and consumption of the architectural artifact is reviewed using tools of analysis that physically account for the flow of materials into and out of various spatial and temporal scales and boundaries.
J. Fernandez

4.411 Building Technology Laboratory
Prereq: 8.02, 18.02
U (Fall)
2-4-6 Institute LAB
Concepts of building technology and experimental methods. Projects vary yearly and have included design and test of strategies for daylighting, passive heating and cooling, and improved indoor air quality via natural ventilation. Experimental methods focus on measurement and analysis of thermally driven and wind-driven airflows, lighting intensity and glare, and heat flow and thermal storage. Experiments are conducted at model scale and are compared with simulation. Motivated by ongoing fieldwork in developing countries.
L. K. Norford

(Same subject as 2.67j)
Prereq: 2.006 or 4.42
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Explores the fundamentals of heating, ventilating, and air-conditioning (HVAC) systems. Topics include discussion of psychrometrics, air conditioning processes, thermal comfort, indoor air quality and outdoor design conditions. Emphasis on the calculation of heating and cooling load in order to size suitable HVAC equipment, estimate energy consumption of the HVAC equipment, and control HVAC equipment. Both manual and computer methods are used. One or more site visits.
L. K. Norford, L. Glicksman

4.428, 4.429 Special Problems in Energy in Buildings
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.
L. R. Glicksman, L. K. Norford

4.430 Daylighting
Prereq: 4.401 or permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Provides the tools necessary for an efficient integration of daylighting issues in the overall design of a building. Fundamentals of daylighting and electric lighting are introduced and their relevance to design decisions emphasized: benefits and availability of daylight, solar radiation and sun course, photometry, vision and color perception, daylighting metrics, visual and thermal comfort, electric lighting. More advanced topics are presented and practiced through the design project and homework assignments, such as primary and advanced lighting design strategies, and design and assessment tools for lighting management.
M. Andersen

4.431 Architectural Acoustics
Prereq: 4.401
G (Spring)
Units arranged H-LEVEL Grad Credit
Describes interactions between people and sound, indoors and outdoors, and uses this information to develop acoustical design criteria.
C. J. Rosenberg

**4.438 Special Problems in Architectural Lighting**
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.
M. Andersen

**4.439 Special Problems in Architectural Lighting**
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Introduction to the physical process behind the design of a building's envelope, interior and equipment. Integration of technological constraints in architectural design: Response to climate, construction methods and issues, heat and air flow, thermal comfort and insulation, passive and active heating and cooling, natural and electric lighting, visual comfort, acoustics.
M. Andersen

**4.440 Basic Structural Design**
Prereq: 18.02
U (Spring)
3-3-6 REST

Introduces the design and behavior of large-scale structures and structural materials. From Gothic cathedrals to modern suspension bridges, subject emphasizes the development of structural form and the principles of structural design. Introduces design methods for timber, masonry, concrete, and steel applied to long-span roof systems, bridges, and high-rise buildings. Includes environmental assessment of structural systems and materials. Laboratory to solve structural problems by building and testing simple models.
J. Ochsendorf

**4.444 Analysis of Historic Structures**
(Subject meets with 4.445)
Prereq: —
U (Spring)
3-0-9

**4.445 Analysis of Historic Structures**
(Subject meets with 4.444)
Prereq: —
G (Spring)
3-0-6

Technical and historical studies of structures in architecture and engineering. Focuses on the design and assessment of historic structures in masonry, timber, concrete, and metal. Assignments include problem sets and presentations, with a major focus on a final research paper. Previous student projects have researched Gothic flying buttresses, wooden covered bridges, Roman aqueducts, iron train stations, etc. Graduate student's term project should result in a publishable paper.
J. Ochsendorf

**4.447 Design for Sustainability (New)**
(Same subject as 1.819J)
Prereq: Permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit

See description under subject 1.819J.
J. Connor, J. Ochsendorf, E. Adams

**4.448, 4.449 Special Problems in Structural Design**
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Supplementary structural design on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.
Building Technology Staff

**4.461 Building Technology I: Materials and Construction**
Prereq: —
G (Fall)
3-1-5

Materials and methods of construction are essential elements of architectural design. In addition, static equilibrium is the first step in establishing architectural geometries in two- and three-dimensional space. Both topics are treated together and applied to selected contemporary construction systems and structural morphologies. Understanding of the integration of materials as functioning structural form is fostered in lectures, case studies, and field trips. Attention is paid to the importance of working details as part of a technically coordinated whole.
Required of M.Arch. students.
J. Fernandez

**4.462 Building Technologies II: Building Structural Systems I**
Prereq: 4.461 or permission of instructor
G (Spring)
3-2-4

Introduces the design and behavior of large-scale structures and structural materials. Emphasizes the development of structural form and the principles of structural design. Introduces design methods for timber, masonry, concrete, and steel applied to long-span roof systems, bridges, and high-rise buildings. Includes environmental assessment of structural systems and materials. Laboratory to solve structural problems by building and testing simple models.
Required of M.Arch students.
J. Ochsendorf

**4.463 Building Technologies II: Building Structural Systems II**
Prereq: 4.462 or permission of instructor
G (Fall)
3-2-4

Addresses advanced structures, exterior envelopes, and contemporary production technologies. Continues the exploration of structural elements and systems, expanding to include more complex determinate, indeterminate, long-span, and high-rise systems. Topics include reinforced concrete, steel and engineered-wood design, and an introduction to tensile systems. The contemporary exterior envelope is discussed with an emphasis on the classification of systems, their performance attributes, and advanced manufacturing technologies. Required of M.Arch students.
J. Fernandez, J. Ochsendorf

**4.464 Building Technologies IV: Energy in Building Design**
Prereq: 4.463, or permission of instructor
G (Spring)
3-1-5

Explores aspects of climate relevant to building design, and applies concepts and methods to energy-efficient and environmentally responsible building design. Topics include climate and comfort parameters, energy systems, and environmental implications of building. Emphasizes practical applications for environmental design.
Required of M.Arch students.
L. Glicksman, L. Norford
4.481 Building Technology Seminar
Prereq: Permission of instructor
G (Fall)
2-0-1 H-LEVEL Grad Credit
Introduction to ongoing research activities in building technology and development of student research projects. Topics drawn from indoor air quality and thermal comfort, building systems analysis and control, building energy uses, daylighting and new building materials and construction techniques. Organized as a series of two- to three-week sessions that consider topics through readings, discussions, design and analysis projects, and student presentations.
J. Fernandez, L. R. Glicksman, L. K. Norford, J. Ochsendorf, M. Andersen

4.488 Preparation for SMBT Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Building Technology Staff

4.489 Preparation for Building Technology PhD Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Building Technology Staff

4.491–4.493 Special Problems in Building Technology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

4.494 Special Problems in Building Technology
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

4.495 Special Problems in Building Technology
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

4.497, 4.498 Special Problems in Building Technology
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

4.500 Introduction to Design Computing
Prereq: —
U (Spring)
2-2-8
Introduces students to architectural design and computation through the use of computer modeling, rendering, and digital fabrication. Focus on the exploration of space- and placemaking through the use of computer rendering and design construction through CAD/CAM fabrication. Students design a small building using computer models leading to a full package of physical and virtual materials, from computer generated drawings to rapid, prototyped models. Enrollment limited to 24 students, with priority given to Course 4 majors and minors.
L. Sass

4.501 Architectural Construction and Computation
Prereq: 4.500
U (Fall)
2-2-8
Investigates the use of computers in architectural design and construction. Begins with a pre-prepared computer model, which is used for testing and process investigation in construction. Explores the process of construction from all sides of practice: detail design, structural design, legal and computational issues. Limited to 10 with priority given to Course 4 majors and minors.
L. Sass

4.510 Digital Design Fabrication
Prereq: 4.560 or 4.500
G (Fall)
2-2-8 H-LEVEL Grad Credit
Introductory subject in advanced computing, rapid prototyping, and CAD/CAM fabrication for architects. Focuses on the relationship between design and various forms of computer modeling/CAD/CAM tools as output material. Presents the process of design and construction using CAD files introduced by the office of Gehry Partners during the construction of the Guggenheim Museum in Bilbao, Spain. Taught in phases starting with rapid prototyping and ending with CAD CAM of building components fabricated from CAD files. Limited to 36 students.
L. Sass

4.512 Special Projects in Architectural Digital Fabrication
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Individual research or project team work with digital fabrication software and devices in the computational design process.
L. Sass

4.513 Special Problems in Digital Fabrication
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

4.514 Special Problems in Digital Fabrication (New)
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Supplementary work on the topic of digital fabrication. For individual research or project team work in advancing understanding of digital fabrication software and devices in the computational design process.
L. Sass
4.520 Computational Design I: Theory and Applications
(Subject meets with 4.521)
Prereq: —
U (Fall) 3-0-9
4.521 Computational Design I: Theory and Applications
(Subject meets with 4.520)
Prereq: —
G (Fall) 3-0-6
Introduces design as a computational enterprise in which rules are developed to compose and describe architectural and other designs. Topics include shapes, shape arithmetic, symmetry, spatial relations, shape computations, and shape grammars. Focuses on the application of shape grammars in creative design. Teaches shape grammar fundamentals through exercises with abstract shape grammars. Discusses issues related to practical applications of shape grammars.
T. Knight

4.522 Computational Design II: Theory and Applications
(Subject meets with 4.523)
Prereq: 4.520 or permission of instructor
U (Spring) 3-0-9
4.523 Computational Design II: Theory and Applications
(Subject meets with 4.522)
Prereq: 4.520, 4.521 or permission of instructor
G (Spring) 3-0-6
Introduces advanced topics in shape grammar theory and applications. Discusses generalizations of the shape grammar formalism that permit greater flexibility in computing designs. These include parametric grammars and parametric design, parallel grammars, and color grammars. Introduces color grammars through exercises. Discusses the generative and expressive powers of grammars in relation to other computational design systems.
T. Knight

4.540 Introduction to Shape Grammars I
Prereq: —
G (Fall) 3-0-6
4.541 Introduction to Shape Grammars II
Prereq: 4.540
G (Spring) 3-0-6 H-LEVEL Grad Credit
An in-depth introduction to shape grammars and their applications in architecture and related areas of design. Shapes in the algebras Uij, in the algebras Vi j and Wij incorporating labels and weights, and in algebras formed as composites of these. Rules and computations. Shape and structure. Designs. G. Stiny

4.542 Background to Shape Grammars
Prereq: 4.541 or permission of instructor
G (Spring) 3-0-6 H-LEVEL Grad Credit
Can be repeated for credit
An advanced examination of the shape grammar formalism and its relationship to some key issues in a variety of other fields, including art and design, philosophy, history and philosophy of science, linguistics and psychology, literature and literary studies, logic and mathematics, and artificial intelligence. Student presentations and discussion of selected readings are encouraged. Topics vary from year to year. Can be repeated with permission of instructor.
G. Stiny

4.543 Special Problems in Shape Grammars
Prereq: 4.520, 4.540, or permission of instructor
G (Fall, IAP, Spring) Units arranged H-LEVEL Grad Credit
Can be repeated for credit
An opportunity to use shape grammars or related algorithmic devices to characterize detailed designs in a historical corpus or original designs conceived from scratch. Projects may have their focus in architecture or in any other area of design (e.g. product design) where there is a strong interaction between form and function. Questions of style and stylistic change, type, and value stressed in relationship to shape grammars and the algorithmic processes they encourage. Project work may extend over multiple terms.
Computation Staff

4.550 Workshop in Architectural Computation (4.594)
Prereq: Permission of instructor
U (Fall, IAP, Spring) Units arranged Can be repeated for credit
4.551 Workshop in Architectural Computation (4.595)
Prereq: Permission of instructor
U (Fall, IAP, Spring) Units arranged [P/D/F] Can be repeated for credit
4.552–4.553 Workshop in Architectural Computation
Prereq: Permission of instructor
G (Fall, IAP, Spring) Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for group exploration of a special topic in computation through research-focused design projects or exercises. Registration subject to prior arrangement of topic and supervision by staff.
Computation Staff

4.560 Geometric Modeling
Prereq: Permission of instructor
G (Fall) 2-2-8
Introduces the fundamentals of three-dimensional geometric modeling and associated computer-aided design as well as visualization applications in architecture, urban design, and computer graphics production. Provides a theoretical foundation to a selection of current hardware and software tools. Extensive opportunities to develop practical skills through lab sessions and regular practical exercises. Background in computational skills is an advantage, but not required. Students acquire the skills necessary to undertake independent CAD projects in design studios or other professional settings.
T. Nagakura

4.562 Architecture in Motion Graphics
Prereq: 4.560 or permission of instructor
G (Spring) 2-2-8 H-LEVEL Grad Credit
Provides an opportunity to undertake advanced projects in architectural visualization with an emphasis on the use of computer graphics animation and video production media. Introduces students to advanced visualization software and
teaches them to explore spatial expressions in motion graphics format. Selected literature and video materials on architecture and film reviewed to initiate discussion sessions. Previous experience in 3-D modeling software essential. Workshop format.

T. Nagakura

4.564 Formal Design Knowledge and Programmed Constructs
Prereq: 4.560 or permission of instructor
G (Spring)
2-2-8 H-LEVEL Grad Credit
Can be repeated for credit
Provides practical and theoretical foundations to explore computational issues relevant to representation of architectural forms and design knowledge. Students learn basic concepts in a computer programming language and acquire practical skills to develop their own software tools for architectural design. Topics include parametrized objects, procedural representation of form, typology and architectural grammar, shape recognition problem, constraint propagation, inter-application communication, and internet-based distribution interface.

T. Nagakura

4.566 Advanced Projects in Digital Media
Prereq: 4.562, 4.564 or permission of instructor
G (Fall)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Develop independent projects in the study of digital media as it relates to architectural design. Students propose a project topic such as digital design tool, modeling and visualization, motion graphics, design knowledge representation and media interface.

T. Nagakura

4.580 Inquiry into Computation and Design
Prereq: —
G (Fall)
3-0-9
Explores the varied nature and practice of computation in design. Different computational approaches for understanding and thinking about design, and for doing design, are introduced through lectures, readings, discussions, and guest visits by Computation group faculty and others. Topics may vary from year to year. Aims to develop a critical view and awareness of assumptions about computation in design beyond the specifics of techniques and tools, and to open avenues for further research. Required for first year SMArchS students in Computation.

T. Knight

4.581 Proseminar in Computation
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 [P/D/F] H-LEVEL Grad Credit
Introduction to traditions of research in design and computation scholarship. Required subject for PhD students in the area of design and computation.

Computation Staff

4.582 Research Seminar in Computation
Prereq: 4.580
G (Fall, Spring)
3-0-9 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
In-depth presentations of current research in design and computation.

Computation Staff

4.583 PhD Forum in Computation
Prereq: Permission of instructor
G (Fall, Spring)
3-0-0 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Group discussions and presentation of ongoing PhD research in the Computation program.

Computation Staff

Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Computation Staff

4.590 Special Problems in Architectural Computation
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Opportunity for individual or group pursuit of topics not covered by regular computation offerings. Registration subject to prior arrangement of topic and supervision by staff.

Computation Staff

4.592, 4.593 Special Problems in Computation
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
4.598–4.599 Special Problems in Computation (New)
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group pursuit of topics not covered by regular computation offerings. Registration subject to prior arrangement of topic and supervision by staff.

Computation Staff

4.601 Introduction to Art History
Prereq: —
U (Fall)
3-2-7 HASS-D, Category 3
An introduction to the history of western art that explores the wide range of works constituting the canonical core of painting and sculpture from the Renaissance to the present. Engages diverse methodological perspectives on the symbolic meanings and contextual functions of works of art, and considers culture’s place in the social world. Includes trips to local museums.

HTC Staff

4.602 Modern Art and Mass Culture
Prereq: —
U (Spring)
4-0-8 HASS-D, Category 3, CI-H
Introduction to modern art and theories of modernism and postmodernism. Focuses on the way artists use the tension between fine art and mass culture to mobilize a critique of both. Examines objects of visual art, including painting, sculpture, architecture, photography, and video. These objects are viewed in their interaction with advertising, caricature, comics, graffiti, television, fashion, folk art, and “primitive” art.

C. Jones

4.605 Introduction to the History and Theory of Architecture
Prereq: —
U (Fall)
4-0-8 HASS-D, Category 3
Provides an outline of the history of architecture and urbanism from Ancient Egypt to the present. Analyzes buildings as the products of culture and in relation to the special problems of architectural design. History of architecture with an urbanist perspective that stresses the cultural and political context from which building
4.607 Thinking About Architecture: In History and At Present
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Studies the interrelationship of theory, history, and practice. Looks at theory not as specialized discourse relating only to architecture, but as touching on many issues, whether they be cultural, aesthetic, philosophical, or professional. Topics and examples are chosen from a wide range of materials, from classical antiquity to today. Required of MArch students.
M. Jarzombek

4.609 Seminar in the History of Art and Architecture
Prereq: Permission of instructor
U (Fall, Spring)
3-0-9
Examination of historical method in art and/or architecture focusing on periods and problems determined by the research interest of the faculty member leading the seminar. Emphasis on critical reading and viewing and direct tutorial guidance. Extensive discussion.
HTC Staff

4.611 Civic Architecture in Islamic History
(Subject meets with 4.613)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged
4.613 Civic Architecture in Islamic History
(Subject meets with 4.611)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Studies select examples of palatial, residential, commercial, and landscape architecture in the Islamic world in chronological order. Examines the formation and developments of architectural traditions, their possible models, their survival, their regional transformations, and the various influences at different historical junctions, all within the framework of the general Islamic culture.
N. Rabbat

4.614 Religious Architecture and Islamic Cultures
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 3
Introduces the history of Islamic cultures through their most vibrant material signs: the religious architecture that spans fourteen centuries and three continents — Asia, Africa, and Europe. Studies a number of representative examples from the House of the Prophet to the present in conjunction with their social, political, and intellectual environments. Presents Islamic architecture both as a full-fledged historical tradition and as a dynamic and interactive cultural catalyst that influenced and was influenced by the civilizations with which it came in contact.
N. Rabbat

4.615 The Architecture of Cairo
(Subject meets with 4.618)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Cairo as a major cultural, political, and economic center that influences the Arab world, Africa, and the Islamic world. History of the city from initial settlement (640s) to the present, urban and architectural developments, and connections to their Islamic and Mediterranean architectural and cultural contexts.
N. Rabbat

4.616 Cultural Signification in Architecture
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged
H-LEVEL Grad Credit
Seminar on the issue of meaning in architecture. Establishes historical and theoretical frameworks for investigations. Analyzes traditions, transformations, and inventions in architecture as a conveyor of messages that transcend the stylistic, formal, and iconographic domains to include an assessment of some of the political, ideological, social, and cultural concerns of the builders and patrons both synchronically and diachronically. Critically reviews the methodologies and theoretical premises of studies on meaning and iconography in Islamic architecture.
N. Rabbat

4.617 Issues in Islamic Urbanism
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged
H-LEVEL Grad Credit
Seminar on selected topics from Islamic urban history. Examines patterns of settlement, urbanization, and architectural production in various places and periods from late antiquity to modern times. Discusses the leading factors in shaping and transforming civic forms, structures, and attitudes. Critically analyzes the body of literature concerned with the ancient, medieval Islamic, colonial, and post colonial city types. Research paper required. Open to qualified undergraduates.
N. Rabbat

4.618 The Architecture of Cairo
(Subject meets with 4.615)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged
Studies Cairo as a major cultural, political, and economic center that influences the Arab world, Africa, and the Islamic world. Narrates the history of the city from its initial settlement (640s) to the present, reviews its urban and architectural developments, and connects them to their Islamic and Mediterranean architectural and cultural contexts.
N. Rabbat

4.619 Historiography of Islamic Architecture
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Critical review of literature on Islamic architecture in the last two centuries and analyzes its historical and theoretical frameworks. Challenges the tacit assumptions and biases of standard studies of Islamic architecture and addresses historiographic and critical questions concerning how knowledge of a field is defined, produced and reproduced. Required for SMArchS students studying Islamic architecture.
N. Rabbat

4.621 Orientalism and Representation
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
Units arranged
H-LEVEL Grad Credit
Seminar on the historiography and politics of representation with special focus on Orientalist traditions in architecture, art, literature,
and scholarship. Critically analyzes pivotal texts, projects, and images that informed the cross-cultural encounters between Europe and the “Orient” from Antiquity to the present. Discusses how political and ideological attitudes and beliefs informed both the construction and reproduction of European knowledge about the Orient as well as the revisionist “Oriental” self-representations. Research paper required. Required for SMArchS students studying Islamic architecture.

**N. Rabbat**

4.627 Special Problems in Islamic and NonWestern Architecture
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit
**4.628, 4.629 Special Problems in Islamic and Nonwestern Architecture**
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Supplementary work on individual or group basis in the history, theory, and criticism of architecture and urban form in the Islamic World. Registration subject to prior arrangement for subject matter and supervision by staff.

**N. Rabbat**

4.634 Renaissance Architecture
(Subject meets with 4.635)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged
**4.635 Renaissance Architecture**
(Subject meets with 4.634)
Prereq: 4.605
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
A history of architectural design, architectural practice, and the role of architecture in the culture and society of Renaissance Italy. Topics include the formation and development of the modern classical style, the new techniques of architectural drawing, the relationship of architecture to the new visual culture, the role of architecture in the transformation of the political structure of Italy. Graduate students are expected to complete additional assignments.

**D. H. Friedman**

4.638 Advanced Study in Renaissance Architecture
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Seminar on a selected topic from Renaissance architecture. Requires original research and presentation of a report.

**D. H. Friedman**

4.640 Advanced Study in Critical Theory of Architecture
Prereq: Permission of instructor
G (Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Seminar on a selected topic in critical theory. Requires original research and presentation of oral and written report.

**A. Dutta**

4.641 19th-Century Art
(Subject meets with 4.644)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8 HASS
Survey of major artists and movements from neoclassicism to post-impressionism with an emphasis on French painting and the emergence of the avant-garde. Topics include art and the revolutionary public; mythologies of the romantic artist; colonialism and its image; the demise of history painting; the salon, the museum and the dealer/critic system; eroticism and visuality; the spectacle of modern life. Strikes a balance between historical contexts, critical debates, and visual analyses of specific works in order to assess art’s engagement with social and political experience.

**HTC Staff**

4.642 Advanced Study in Modern Art
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Seminar on a selected topic from modern art, stressing theoretical or critical issues of contemporary concern. Requires original research and presentation of oral and written reports.

**HTC Staff**

4.644 19th-Century Art
(Subject meets with 4.641)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-5
See description under subject 4.641.

**HTC Staff**

4.645 Selected Topics in Architecture—1750 to the Present
Prereq: 4.605
G (Fall)
3-0-6
General study of modern architecture as a response to important technological, cultural, environmental, aesthetic, and theoretical challenges after the European Enlightenment. Focus on the theoretical, historiographic, and design approaches to architectural problems encountered in the age of industrial and post-industrial expansion across the globe, with specific attention to the dominance of European modernism in setting the agenda for the discourse of a global modernity at large. Explores modern architectural history through thematic exposition rather than as simple chronological succession of ideas. Required of all first-year MArch students.

**A. Dutta**

4.650 Advanced Study in Cultural and Comparative Studies of Architecture
Prereq: Permission of instructor
G (Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Seminar on selected topics in cultural and comparative studies of architecture. Requires original research and presentation of oral and written report.

**A. Dutta**

4.651 20th-Century Art
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Critical examination of major developments in European, Asian and American art from 1940 to the present. Surveys the effects of art’s engagements with modernization, radical politics, utopianism, mass culture, changing conceptions of mind and human nature, new technologies, colonialism and postcolonialism, and other significant aspects of recent history.

**C. Jones**
4.654–4.656 Advanced Study in Modern Architecture
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Seminar or lecture on a selected topic in the architecture of the late 18th century to the present, in Europe and America. Requires original research and presentation of oral and written reports.
S. Anderson, Staff

4.661 Theory and Method in the Study of Architecture and Art
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Studies theoretical and historiographical works pertaining to the fields of art and architectural history. Members of seminar pursue work designed to examine their own presuppositions and methods. Open only to PhD candidates and other advanced students. Required of HTC PhD and SMArchS students.

4.662 Advanced Study in the History of Urban Form
Prereq: Permission of instructor
G (Fall)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Seminar on a selected topic in the history of urban form. Requires original research and presentation of a report.
D. H. Friedman

4.663 History of Urban Form
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
Units arranged H-LEVEL Grad Credit
Studies in the history of the physical city from Antiquity to the present, with points of special focus determined by the instructor. Analyzes the typologies of urban buildings, public places, and city plans in their relation to changing contexts of culture, politics, and the structure of public and private institutions.
D. H. Friedman

4.665 Contemporary Architecture and Critical Debate
Prereq: 4.123 or 4.125
G (Spring)
3-0-6
Critical review of works, theories, and polemics in architecture in the aftermath of WWII. Aim is a historical understanding of the period and the development of a meaningful framework to assess contemporary issues in architecture. Special attention paid to historiographic questions of how architects construe the terms of their “present.” Required of M.Arch. students.

Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Special topics in the history, theory, and criticism of architecture and urban form, varying at the discretion of the instructor.

4.670 Nationalism, Internationalism, and Globalism in Modern Art
(Subject meets with 4.671)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged
4.671 Nationalism, Internationalism, and Globalism in Modern Art
(Subject meets with 4.670)
Prereq: 4.601, 4.606, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-1-8
Modern art emerged in an age of unprecedented nationalism and imperial expansion. Students study how international modernism interacted with the concept of “nation” and how contemporary discourse concerning globalization changes that dynamic. Seminar attendance, visits to art museums, and a research paper required.
C. Jones

4.672 Installation Art
(Subject meets with 4.673)
Prereq: —
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
Units arranged

4.673 Installation Art
(Subject meets with 4.672)
Prereq: 4.601, 4.606, or permission of instructor
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9
Focuses on a specific genre of contemporary art that produces environments rather than portable “art objects.” Installation art is viewed from a historical perspective, as a rejection of the modernist aesthetic of purity and the neutral white gallery space. This site-specific art is also seen to develop previous exhibition models such as natural history displays or merchandising conventions.
C. Jones

Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Additional credit for extended project work in connection with a seminar with invariable units. Registration subject to prior arrangement for subject matter and supervision by staff.

4.689 Preparation for History, Theory, and Criticism — PhD Thesis
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

H. Staff
4.691 Special Studies in the History, Theory, and Criticism of Art
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit
4.692, 4.693 Special Studies in the History, Theory, and Criticism of Art
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Individual or group projects on topics in the history, theory, and criticism of art. Registration subject to prior arrangement for subject matter and supervision by staff.
C. Jones, E. Naginski

4.694 Special Studies in the History, Theory, and Criticism of Art and Architecture
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
4.695 Special Studies in the History, Theory, and Criticism of Architecture and Urban Form
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
4.699 Special Studies in the History, Theory, and Criticism of Art and Architecture
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Individual and group projects in the history, theory, and criticism of art and/or architecture. Registration subject to prior arrangement for subject matter and supervision by staff.
HTC Staff

4.THT Thesis Research Design Seminar (New)
(Same subject as 11.THT)
Prereq: —
U (Fall)
3-0-9
Can be repeated for credit
See description under subject 11.THT.
C. Abbanat

4.ThU Undergraduate Thesis
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Program of thesis research leading to the writing of an SB thesis, to be arranged by the student and an appropriate MIT faculty member. Intended for seniors. 12 units recommended.
Architecture Staff

4.JUR Undergraduate Research in Architecture
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
4.JUR Undergraduate Research in Architecture
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Research and project activities, which cover the range represented by the various research interests and projects in the department. Students who wish a letter grade option for their work must register for 4.URG.
J. Fernandez

4.ThG Graduate Thesis
Prereq: —
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research and writing of thesis; to be arranged by the student with supervising committee.
Staff
5.00 Applications of Technology in Energy and the Environment
Engineering School-Wide Elective Subject.
(Offered under: 1.149, 2.63, 5.00, 10.579, 22.813, ESD.174)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 22.813.
J. Deutch, R. Lester

5.03 Principles of Inorganic Chemistry I
Prereq: 5.12
U (Spring)
4-0-8
Presents principles of chemical bonding and molecular structure, and their application to the chemistry of representative elements of the periodic system.
J. Peters, C. Cummins

5.04 Principles of Inorganic Chemistry II
Prereq: 5.03
U (Fall)
4-0-8
Systematic presentation of the chemical applications of group theory. Emphasis on the formal development of the subject and its applications to the physical methods of inorganic chemical compounds. Against the backdrop of electronic structure, the electronic, vibrational, and magnetic properties of transition metal complexes are presented and their investigation by the appropriate spectroscopy described.
D. G. Nocera

5.05 Principles of Inorganic Chemistry III
Prereq: 5.03, 5.04
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-4 H-LEVEL Grad Credit
Principles of main group (s and p block) element chemistry with an emphasis on synthesis, structure, bonding, and reaction mechanisms.
Instructor TBD

5.061 Principles of Organometallic Chemistry
Prereq: 5.03, 5.04
G (Fall)
2-0-4 H-LEVEL Grad Credit
A comprehensive treatment of organometalic compounds of the transition metals with emphasis on structure, bonding, and synthesis. Half-term subject, meets second half of term.
R. R. Schrock

5.062 Principles of Bioinorganic Chemistry
Prereq: 5.03
G (Fall)
4-0-8 H-LEVEL Grad Credit
Delineates principles that form the basis for understanding how metal ions function in biology. Includes the choice, uptake and assembly of metal-containing units; metal-induced folding of biomolecules; control of metal ion concentrations in cells; electron-transfer chemistry; atom and group transfer chemistry; protein tuning of metal properties; and applications to diagnosis and treatment of disease.
S. J. Lippard, J. Stubbe

5.063 Crystal Structure Refinement (5.841)
Prereq: 5.068, 5.069, or permission of instructor
G (Fall)
1-2-3 H-LEVEL Grad Credit
Practical aspects of crystal structure determination from data collection strategies to data reduction and basic and advanced refinement problems of organic and inorganic molecules.
P. Mueller

5.064 Physical Inorganic Chemistry
Prereq: 5.03, 5.04
G (Spring)
2-0-4 H-LEVEL Grad Credit
Discussion of physical methods used to probe the electronic and geometric structures of inorganic compounds. Included are resonance Raman spectroscopy, solid state and solution magnetocraphic methods, electron paramagnetic resonance spectroscopy, advanced EPR methods (ENDOR AND ESEEM), cryoreduction to create EPR-active states, X-ray absorption spectroscopy (XANES and EXAFS), Mössbauer spectroscopy, and advanced kinetic and electrochemical methods. Applications to current research problems in inorganic and bioinorganic chemistry. Half-term subject, meets second half of the term.
S. J. Lippard

5.065 Crystal Structure Analysis
Prereq: 5.03, 5.04
G (Spring)
2-0-4 H-LEVEL Grad Credit
Introduction to X-ray crystallography: symmetry in real and reciprocal space, space and Laue groups, geometry of diffraction, structure factors, phase problem, direct and Patterson methods, electron density maps, structure refinement, crystal growth, powder methods, limits of diffraction methods, structure data bases. Half-term subject, meets first half of the term.
P. Mueller

5.07 Biological Chemistry I
Prereq: 5.12
U (Fall)
4-0-8 REST
Credit cannot also be received for 7.05
Chemical and physical properties of the cell and its building blocks. Structures of proteins and principles of catalysis. The chemistry of organic/inorganic cofactors required for chemical transformations within the cell. Basic principles of metabolism and regulation in pathways, including glycolysis, gluconeogenesis, fatty acid synthesis/degradation, pentose phosphate pathway, Krebs cycle and oxidative phosphorylation, DNA replication, and transcription and translation.
D. Kemp, S. Licht

5.08 Biological Chemistry II
(Same subject as 7.08)
(Subject meets with 7.80)
Prereq: 5.12; 5.07 or 7.05
U (Spring)
4-0-8
More advanced treatment of biochemical mechanisms that underlie biological processes. Topics include macromolecular machines such as the ribosome, the proteosome, fatty acid synthases as a paradigm for polyketide synthases and nonribosomal polypeptide synthases, metal cluster assembly and oxidative stress. Emphasis is on
experimental methods used to unravel these processes and how these processes fit into the cellular context and coordinate regulation.
A. Y. Ting, J. Stuble

5.111 Principles of Chemical Science
Prereq: —
U (Fall, Spring)
5-0-7 CHEMISTRY
Credit cannot also be received for 5.112
Introduction to chemistry, with emphasis on basic principles of atomic and molecular electronic structure, thermodynamics, acid-base and redox equilibria, chemical kinetics, and catalysis. Introduction to the chemistry of biological, inorganic, and organic molecules.
Fall: C. Drennan, K. A. Nelson
Spring: A. Klibanov, Staff

5.112 Principles of Chemical Science
Prereq: —
U (Fall)
5-0-7 CHEMISTRY
Credit cannot also be received for 5.111
Introduction to chemistry for students with an unusually strong background in chemistry. Knowledge of calculus equivalent to 18.01 is recommended. Emphasis on basic principles of atomic and molecular electronic structure, thermodynamics, acid-base and redox equilibria, chemical kinetics, and catalysis. Applications of basic principles to problems in metal coordination chemistry, organic chemistry, and biological chemistry.
M. G. Bawendi, C. C. Cummins

5.12 Organic Chemistry I
Prereq: 5.111, 5.112, or 3.091
U (Fall, Spring)
5-0-7 REST
Introduction to organic chemistry. Development of basic principles to understand the structure and reactivity of organic molecules. Emphasis on substitution and elimination reactions and chemistry of the carbonyl group. Introduction to the chemistry of aromatic compounds.
Fall: S. E. O’Connor, B. Imperiali
Spring: R. L. Danheiser, T. F. Jamison

5.13 Organic Chemistry II
Prereq: 5.12
U (Fall)
5-0-7
Intermediate organic chemistry. Synthesis, structure determination, mechanism, and the relationships between structure and reactivity emphasized. Special topics in organic chemistry included to illustrate the role of organic chemistry in biological systems and in the chemical industry.
M. Movassaghi, S. Buchwald

5.22) Biological Engineering Design
(Same subject as 20.380J)
Prereq: 7.06, 20.309, 20.330
U (Spring)
5-0-7
See description under subject 20.380J.
J. M. Essigmann, R. S. Langer, R. Sasisakharan

5.24) Archaeological Science
(Same subject as 3.985J, 12.011J)
Prereq: 3.091, 5.11, 5.111, 5.112, or 8.01
U (Spring)
3-1-5 HASS
See description under subject 3.985J.
H. N. Lechman, J. Stubbe, F. A. Frey

5.301 Chemistry Laboratory Techniques
Prereq: 5.111 or 5.112; permission of instructor
U (IAP)
1-4-1 [P/D/F]
Practical training in basic chemistry laboratory techniques. Intended to provide freshmen with the skills necessary to undertake original research projects in chemistry. Freshmen only. Enrollment limited.
Staff

5.302 Introduction to Experimental Chemistry
Prereq: 5.111, 5.112, or 3.091; permission of instructor
U (IAP)
0-3-0 [P/D/F]
Illustrates fundamental principles of chemical science through hands-on experience with chemical phenomena. Freshmen only. Enrollment limited.
Staff

5.303 Principles of Chemical Science Laboratory
Prereq: 5.111
U (Spring)
0-3-0 [P/D/F]
Illustrates topics introduced in 5.111 through hands-on laboratory experiences in the areas of atomic structure, spectroscopy, modeling of molecules, heat of reaction, equilibria, acid-base titration, oxidation and reduction reactions, kinetics and coordination chemistry. Limited to 20 students.
Staff

5.310 Laboratory Chemistry
Prereq: 5.12
U (Fall, Spring)
2-8-2 Institute LAB
Introduces experimental chemistry for students who are not majoring in Course 5. Principles and applications of chemical laboratory techniques, including preparation and analysis of chemical materials, measurement of pH, gas and liquid chromatography, visible-ultraviolet spectrophotometry, infrared spectroscopy, kinetics, data analysis, and elementary synthesis. Enrollment limited.
Fall: J. Peters
Spring: S. Licht

5.33 Advanced Chemical Experimentation and Instrumentation
Prereq: 5.32, 5.61
U (Fall)
2-13-6
Advanced experimentation, with particular emphasis on chemical synthesis and the fundamentals of quantum chemistry illustrated through molecular spectroscopy. Instruction and practice in the written and oral presentation of experimental results.
A. Tokmakoff

5.35 Introduction to Experimental Chemistry (New)
(Subject meets with 5.35U)
Prereq: See module descriptions
U (Fall, Spring)
Units arranged Institute LAB
Can be repeated for credit
This 12-unit subject consists of 3 modules, which may be taken during different terms. Modules and prerequisites are as follows:
—Module 1 (Prereq: 5.111, 5.112, or 3.091)
Survey of spectroscopy.
—Module 2 (Prereq: 5.111, 5.112, or 3.091;
Module 1) Synthesis of coordination compounds and kinetics.
—Module 3 (Prereq: 5.111, 5.112, or 3.091;
5.12, Module 2) Fabrication of a polymeric light emitting device.
Enrollment limited. Preference given to Course 5 majors.
Module 1: K. A. Nelson
Module 2: R. R. Schrock
Module 3: T. Swager
5.35 Biochemistry and Organic Laboratory (New)
(Subject meets with 5.35U)
Prereq: See module descriptions
U (Fall, Spring)
Units arranged
Can be repeated for credit
For students who might not take all modules of 5.35. Consult department when choosing a version of 5.35. See description for 5.35. May be taken for 8 or 4 units and repeated for credit up to a total of 12 units.
Module 1: K. A. Nelson
Module 2: R. R. Schrock
Module 3: T. Swager

5.35U Introduction to Organic Chemistry
(Subject meets with 5.35)
Prereq: See module descriptions under subject 5.35
U (Fall, Spring)
Units arranged
Can be repeated for credit
This 12-unit subject consists of 3 modules, which may be taken during different terms. Instruction and practice in the written and oral presentation of experimental results provided.
Modules and prerequisites are as follows:
—Module 2 (Prereq: 5.03, Module 5) Introduction to Organic Synthesis.
—Module 6 (Not Offered Acad Year 2007–2008) (Prereq: 5.03, Module 6, 5.61) Two Electron Bond.
—Module 9 (Not Offered Acad Year 2007–2008) (Prereq: 5.03, Module 6, 5.61) Dinitrogen Cleavage.
Enrollment limited. Preference given to Course 5 majors.

Fall: Modules 8 and 9—Staff
Spring: Module 7—R. L. Danheiser

5.36 Biochemistry and Organic Laboratory (New)
(Subject meets with 5.36U)
Prereq: See module descriptions
U (Fall, Spring)
Units arranged
Can be repeated for credit
This 12-unit subject consists of 3 modules, which may be taken during different terms. Instruction and practice in the written and oral presentation of experimental results provided.
Modules and prerequisites are as follows:
—Module 4 (Prereq: 5.07 or 7.05, Module 2 or 5.310, Module 5) Expression and Purification of Enzyme Mutants. Must be taken simultaneously with Module 5.
—Module 5 (Prereq: 5.07 or 7.05, Module 2 or 5.310, Module 4) Kinetics of Enzyme Inhibition. Must be taken simultaneously with Module 4.
—Module 6 (Prereq: 5.12, Module 2 or 5.310, 5.13) Organic Structure Determination.
Enrollment limited. Preference given to Course 5 majors.

Fall: Module 6—R. L. Danheiser
Spring: Modules 4 and 5—A. Ting

5.37 Organic and Inorganic Laboratory (New)
(Subject meets with 5.37U)
Prereq: See module descriptions
U (Fall, Spring)
Units arranged
Can be repeated for credit
This 12-unit subject consists of 3 modules, which may be taken during different terms. Modules and prerequisites are as follows:
—Module 7 (Prereq: 5.13, Module 6) Introduction to Organic Synthesis.
—Module 8 (Not Offered Acad Year 2007–2008) (Prereq: 5.03, Module 6, 5.61) Two Electron Bond.
—Module 9 (Not Offered Acad Year 2007–2008) (Prereq: 5.03, Module 6, 5.61) Dinitrogen Cleavage.
Enrollment limited. Preference given to Course 5 majors.

Fall: Modules 8 and 9—Staff
Spring: Module 7—R. L. Danheiser

5.4 Advanced Organic Chemistry
(Subject meets with 5.53)
Prereq: 5.13
U (Spring)
4-0-8
Credit cannot also be received for 5.53, 5.56
Application of structure and theory to the study of organic reaction mechanisms: stereochemical features including conformation and stereoelectronic effects; reaction dynamics, isotope effects and molecular orbital theory applied to pericyclic and photochemical reactions; and special reactive intermediates including carbenes, carbanions, and free radicals.
G. Fu

5.44 Organometallic Chemistry
Prereq: 5.43, 5.47, or permission of the instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit
Examination of the most important transformations of organotransition-metal species. Emphasizes basic mechanisms of their reactions, structure-reactivity relationships, and applications in synthesis. Taught first half of term.
S. Buchwald

5.45 Chemistry of Biomolecules I
Prereq: 5.43
G (Fall)
2-0-4 H-LEVEL Grad Credit
Introduction to the synthesis, structure, and chemistry of nucleic acids, proteins, and carbohydrates. Offered first half of term.
S. E. O’Connor

5.46 NMR Spectroscopy and Organic Structure Determination
Prereq: 5.43
G (Spring)
2-0-4 H-LEVEL Grad Credit
Applications of 1-D and 2-D 1H and 13C NMR spectroscopy to organic structure determination. Taught first half of term.
J. H. Simpson

5.47 Tutorial in Organic Chemistry
Prereq: 5.43, permission of instructor
G (Fall)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Systematic review of basic principles concerned with the structure and transformations of organic molecules. Problem-solving workshop format. The program is intended primarily for first-year graduate students with a strong
Subjects 5.35u to 5.65

5.48| The Protein Folding Problem
(Subject meets with 7.88j, 10.543j)
Prereq: 5.02 or 7.24
G (Fall)
4-2-6 H-LEVEL Grad Credit
See description under subject 7.88j.

5.50 Enzymes: Structure and Function
Prereq: 5.07 or 7.05; 5.12, 5.13
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to methods used to elucidate the mechanism of enzyme-catalyzed reactions. Application of steady-state and presteady-state kinetics, isotope effect measurements, site-directed mutagenesis, and mechanism-based inhibitors as tools to investigate the mechanisms of enzymes that have been well-characterized structurally.
J. Stubbe

5.51 Synthetic Organic Chemistry I
Prereq: 5.43
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to the design of syntheses of complex organic compounds.
R. L. Danheiser

5.52 Advanced Biological Chemistry
Prereq: Permission of instructor
G (Fall)
2-2-8 H-LEVEL Grad Credit
Concepts and methods of biochemistry, with emphasis on quantitative aspects of problem analysis and fundamentals of experimental methods. Intended for first-year graduate students with a strong interest in biological chemistry.
A. M. Klibanov

5.53 Molecular Structure and Reactivity I
(Subject meets with 5.43)
Prereq: 5.13, 5.60
G (Fall)
2-0-4 H-LEVEL Grad Credit
Credit cannot also be received for 5.43, 5.56
Reaction mechanisms in organic chemistry; types of mechanisms; reactive intermediates; methods of investigation; and relation of structure to reactivity. Offered first half of term.
G. Fu

5.54 Molecular Structure and Reactivity II
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-4 H-LEVEL Grad Credit
Application of physical principles and methods to contemporary problems of interest in organic chemistry.

5.55 Chemical Tools for Assessing Biological Function
(Subject meets with 20.485 for second half of term)
Prereq: 5.43; 5.07 or 7.05; 5.47 or 5.52
G (Spring)
2-0-4 H-LEVEL Grad Credit
Contemporary bioorganic chemistry and chemical biology, emphasizing the application of chemical approaches to interrogate biochemical function. Selected topics include specific enzyme inhibition as a mechanism for rational drug design; molecular mechanisms of drug resistance; uses of intrinsic and extrinsic reporter functionality to understand biological functions and interactions; chemical methods for probing cellular activities in real time.
B. Imperiali, F. White

5.56 Molecular Structure and Reactivity III
Prereq: 5.03; 5.07 or 7.05; 5.13
G (Spring)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Examination of recent advances in organic, biological, and inorganic and physical chemical research in industry. Taught in seminar format with participation by scientists from industrial research laboratories. Half-term subject, meets second half of term.
R. L. Danheiser

5.57 Chemical Reaction Dynamics
Prereq: 5.13, 5.60; 5.07 or 7.05
G (Fall)
2-0-4 H-LEVEL Grad Credit
Equilibrium and reaction rate theory; phase equilibrium; chemical kinetics; rate laws; mechanisms of elementary reactions.
G. Fu

5.58 Biophysical Chemistry
Prereq: 5.13, 5.60; 5.07 or 7.05
G (Spring)
2-0-4 H-LEVEL Grad Credit
Introduction to the major principles and concepts of biophysical chemistry, with emphasis on the thermodynamics and kinetics of macromolecular reactions, including conformational changes and interactions with small molecules and other macromolecules.
M. Movassaghi

5.59 Physical Chemistry
Prereq: 5.60, 5.61
U (Spring)
4-0-8
Elementary statistical mechanics; transport properties; kinetic theory; solid state; reaction rate theory; and chemical reaction dynamics.
R. G. Griffin, R. W. Field

5.60 Thermodynamics and Kinetics
Prereq: 18.02; 5.111, 5.112, or 3.091
U (Fall, Spring)
5-0-7 REST
Fall: R. W. Field, J. Cao
Spring: K. A. Nelson, M. G. Bawendi

5.61 Physical Chemistry
Prereq: 8.02; 18.02; 5.111, 5.112, or 3.091
U (Fall)
5-0-7 REST
Introductory quantum chemistry; particles and waves; wave mechanics; atomic structure and the Periodic Table; valence and molecular orbital theory; molecular structure; and photochemistry.
R. G. Griffin, T. Van Voorhis

5.62 Physical Chemistry
Prereq: 5.60, 5.61
U (Spring)
4-0-8
Elementary statistical mechanics; transport properties; kinetic theory; solid state; reaction rate theory; and chemical reaction dynamics.
R. G. Griffin, R. W. Field

5.64 Biophysical Chemistry
Prereq: 5.13, 5.60; 5.07 or 7.05
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-4 H-LEVEL Grad Credit
Introduction to the major principles and concepts of biophysical chemistry, with emphasis on the thermodynamics and kinetics of macromolecular reactions, including conformational changes and interactions with small molecules and other macromolecules.

5.65 Molecular Imaging
Prereq: 5.13, 5.60; 5.07 or 7.05
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-4 H-LEVEL Grad Credit
Overview of molecular imaging methods used to study biological systems, ranging from cells to entire organisms. We begin with micrometer-scale imaging, dominated by visible light microscopy. soli discuss physics and instrumentation,
5.70 Statistical Mechanics
Prereq: 5.70, 5.73, 18.075
G (Spring)
2-0-4 H-LEVEL Grad Credit


J. Cao

5.72 Statistical Mechanics
Prereq: 5.70, 5.73, 18.075
G (Spring)
2-0-4 H-LEVEL Grad Credit

Fundamental concepts of quantum mechanics: wave properties, uncertainty principles, Schrödinger equation, and operator and matrix methods. Basic applications to: one-dimensional potentials (harmonic oscillator), three-dimensional centrosymmetric potentials (hydrogen atom), and angular momentum and spin. Approximation methods: WKB method, variational principle, and perturbation theory.

R. Silbey, Staff

5.74 Introductory Quantum Mechanics II
Prereq: 5.73
G (Spring)
2-0-4 H-LEVEL Grad Credit

Time-dependent quantum mechanics and spectroscopy. Topics include perturbation theory, two-level systems, light-matter interactions, relaxation in quantum systems, correlation functions and linear response theory, and nonlinear spectroscopy. Half-term subject, offered first half of term.

A. Tokmakoff

5.77) Topics in Metabolic Biochemistry
(Same subject as 7.75)
(Subject meets with 7.35)
Prereq: 7.05 or 5.07
G (Fall)
4-0-8 H-LEVEL Grad Credit

See description under subject 7.75).

G. M. Brown

5.78 Biophysical Chemistry Techniques
(Subject meets with 7.71)
Prereq: 5.07 or 7.05
G (Spring)
2-0-4 H-LEVEL Grad Credit

Presents principles of macromolecular crystallography that are essential for structure determinations. Topics include crystallography, diffraction theory, symmetry and space groups, data collection, phase determination methods, model building, and refinement. Discussion of crystallography theory complemented with exercises such as crystallography, data processing, and model building. Enrollment limited.

C. Drennan, T. Schwartz

5.80 Advanced Topics of Current Special Interest
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged

Advanced topics of current special interest.

Staff

5.892 Special Topics in Chemistry for Undergraduates
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

Program of study to be arranged by the student and a departmental faculty member.

Staff

5.90 Special Problems in Chemistry
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Directed research and study of special chemical problems. For graduate students only.

R. W. Field

5.913 Seminar in Organic Chemistry
Prereq: Permission of instructor
G (Fall)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

5.914 Seminar in Organic Chemistry
Prereq: Permission of instructor
G (Spring)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Discussion of current journal publications in organic chemistry by graduate students and staff members.

R. L. Danheiser
5.92 Energy, Environment, and Society
Prereq: Permission of instructor
U (Spring)
4-2-6
Explores energy issues and community dynamics at the local level: on the MIT campus and in the cities of Cambridge and Boston. Staff in the Laboratory for Energy and the Environment work with community contacts to develop project ideas of concern to community leaders that have potential to affect local energy management. Students are involved in all aspects of project design, from the refinement of research questions to conclusions and presentation of findings. Includes exercises in written and oral communication and team building. Limited enrollment. Preference to freshmen.
J. I. Steinfeld, J. W. Tester

5.921 Seminar in Biological Chemistry
Prereq: --
G (Fall)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
5.922 Seminar in Biological Chemistry
Prereq: --
G (Spring)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Discusses topics of current interest in biological chemistry by graduate students and staff.
S. Licht

5.931 Seminar in Physical Chemistry
Prereq: 5.60
G (Fall)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
5.932 Seminar in Physical Chemistry
Prereq: --
G (Spring)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Discusses topics of current interest in physical chemistry by staff members and students.
J. Cao

5.941 Seminar in Inorganic Chemistry
Prereq: 5.03
G (Fall)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
5.942 Seminar in Inorganic Chemistry
Prereq: 5.03
G (Spring)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Discusses current research in inorganic chemistry by graduate students and staff.
R. R. Schrock, Staff

5.95 Teaching College-Level Science
(Same subject as 7.59J, 8.395J, 18.094J)
Prereq: --
G (Fall, Spring)
2-0-2 [P/D/F]
Participatory seminar focuses on the knowledge and skills necessary for teaching science in higher education. Topics include: theories of adult learning; course development; promoting active learning, problem solving, and critical thinking in students; communicating with a diverse student body; using educational technology to further learning; lecturing; creating effective tests and assignments; and assessment and evaluation. Students research and present a relevant topic of particular interest. Subject is appropriate for both novices and those with teaching experience.
L. Breslow

5.CME Study at Cambridge University
Prereq: --
U (Fall, Spring)
Units arranged
Can be repeated for credit
Provides credit for students studying at Cambridge University under the Undergraduate Student Exchange Program of the Cambridge-MIT Institute. Credit may be used to satisfy specific SB degree requirements. Consult with department and CME office.
S. T. Ceyer

5.UR Undergraduate Research
Prereq: --
U (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Program of research to be arranged by the student and a departmental faculty member. May be taken for 9 to 12 units a semester, not to exceed a cumulative total of 24 units. A 10-page paper summarizing research is required. Restricted to juniors and seniors.
C. C. Cummins

5.ThG Graduate Thesis
Prereq: --
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of a PhD thesis; to be arranged by the student and an appropriate MIT faculty member.
R. W. Field
**Basic Undergraduate Subjects**

**6.00 Introduction to Computer Science and Programming**
Prereq: —
U (Fall, Spring)
3-7-2 REST

Introduction to computer science and programming for students with little or no programming experience. Students learn how to program and how to use computational techniques to solve problems. Topics include algorithms, simulation techniques, and use of software libraries. Assignments are done using the Python programming language.

*J. V. Guttag*

**6.01 Introduction to EECS I (New)**
Prereq: 8.02
U (Fall, Spring)
2-4-6 1/2 Institute LAB

An integrated introduction to electrical engineering and computer science, taught using substantial laboratory experiments with mobile robots. Key issues in the design of engineered artifacts operating in the natural world: measuring and modeling system behaviors; assessing errors in sensors and effectors; specifying tasks; designing solutions based on analytical and computational models; planning, executing, and evaluating experimental tests of performance; refining models and designs. Issues addressed in the context of computer programs, control systems, probabilistic inference problems, circuits and transducers, which all play important roles in achieving robust operation of a large variety of engineered systems.

*H. Abelson, L. P. Kaelbling, J. K. White*

**6.02 Introduction to EECS II (New)**
Prereq: 6.01; 18.03 or 18.06
U (Fall, Spring)
2-3-7 1/2 Institute LAB

An integrated introduction to electrical engineering and computer science, taught using substantial laboratory experiments that explore communication signals, systems and networks. Physical characterization and modeling of transmission systems in the time and frequency domains; analog and digital signaling; coding; detecting and correcting errors; relating information transmission rate to signal power, bandwidth and noise; engineering of packet-switched networks. These explorations are used to illustrate the role of abstraction and modularity in engineering design; building reliable systems using imperfect components; selecting appropriate design metrics; choosing effective representations for information; analyzing the performance and correctness of algorithms; and tradeoffs in complex systems.

*6 Engineering Design Points.*

*C. G. Sodini, C. J. Terman, M. H. Perrott*

**6.003 Signals and Systems**
Prereq: 6.002 or 6.02
U (Fall, Spring)
4-2-9

Fundamentals of signal and system analysis, with applications drawn from filtering, audio and image processing, communications, and automatic control. Topics include convolution, Fourier series and transforms, sampling and discrete-time processing of continuous-time signals, modulation, Laplace and Z-transforms, and feedback systems.

*4 Engineering Design Points.*

*D. M. Freeman, Q. Hu, J. S. Lim, A. S. Willsky*

**6.004 Computation Structures**
Prereq: 6.001, 6.002; or 6.02
U (Fall, Spring)
4-3-8

Introduces architecture of digital systems, emphasizing structural principles common to a wide range of technologies. Multilevel implementation strategies; definition of new primitives (e.g., gates, instructions, procedures, and processes) and their mechanization using lower-level elements. Analysis of potential concurrency; precedence constraints and performance measures; pipelined and multidimensional systems. Instruction set design issues; architectural support for contemporary software structures.

*4 Engineering Design Points.*

*A. Agarwal, J. del Alamo, J. H. Lang, D. J. Perreault*

**6.005 Principles of Software Development (New)**
Prereq: 6.01, 6.042
U (Fall, Spring)
3-4-5

Introduction to the fundamental principles and techniques of software development that have greatest impact on practice. Topics include capturing the essence of a problem by recognizing and inventing suitable abstractions; key paradigms and design patterns; the role of interfaces and specification in achieving modularity and decoupling; reasoning about code using invariants, preconditions and postconditions; testing, test-case generation and coverage; essentials of programming with objects, functions and abstract types. Student work includes exercises in modeling, design, implementation and reasoning.

*4 Engineering Design Points.*

*D. N. Jackson, R. C. Miller*
6.006 Introduction to Algorithms (New)
Prereq: 6.01, 6.042
U (Fall, Spring)
4-0-8
Introduction to mathematical modeling of computational problems, as well as common algorithms, algorithmic paradigms, and data structures used to solve these problems. Emphasizes the relationship between algorithms and programming, and introduces basic performance measures and analysis techniques for these problems.
R. L. Rivest, S. Devadas, M. Sudan

6.007 Applied Electromagnetics: From Motors to Lasers (New)
Prereq: 6.01, 18.03
U (Fall, Spring)
4-1-7
Applications of electromagnetic principles to classical and modern devices. Basic electrical components, electric motors and generators, power flow, and energy conversion in macroscopic to quantum-scale electrical and electromechanical systems. Photons and their interaction with matter in detectors, sources, optical fibers, and other devices and communication systems.
V. Bulovic

6.011 Introduction to Communication, Control, and Signal Processing
Prereq: 6.003; 6.041 or 18.440
U (Fall, Spring)
4-0-8
A. V. Oppenheim, G. C. Verghese

6.012 Microelectronic Devices and Circuits
Prereq: 6.002
U (Fall, Spring)
4-0-8
Microelectronic devices modeling, and basic microelectronic circuit analysis and design. Physical electronics of semiconductor junction and MOS devices. Relating terminal behavior to internal physical processes; developing circuit models; and understanding the uses and limitations of different models. Use of incremental and large-signal techniques to analyze and design bipolar and field effect transistor circuits, with examples chosen from digital circuits, single-ended and differential linear amplifiers, and other integrated circuits. Design project. 4 Engineering Design Points.
A. I. Akinwande, D. A. Antoniadis, C. G. Fonstad, Jr., C. G. Sodini

6.013 Electromagnetics and Applications
Prereq: 6.003; or 6.02, 6.007
U (Fall, Spring)
4-0-8
Electromagnetic phenomena are explored in modern applications including wireless communications, circuits, computer interconnects and peripherals, optical fiber links and components, microwave communications and radar, antennas, sensors, micro-electromechanical systems, and power generation and transmission. Fundamentals include quasi-static and dynamic solutions to Maxwell’s equations; waves, radiation, and diffraction; coupling to media and structures; guided and unguided waves; resonance; and forces, power, and energy.
D. H. Staelin, E. P. Ippen, J. A. Kong, M. Zahn

6.021j Quantitative Physiology: Cells and Tissues
(Same subject as 2.791j, 20.370j)
(Subject meets with 2.794j, 6.521j, 20.470j, HST.541j)
Prereq: 8.02; 18.03; 2.005, 6.002, 6.003, 6.071, 10.301, or permission of instructor
U (Fall)
5-2-5
Principles of mass transport and electrical signal generation for biological membranes, cells, and tissues. Mass transport through membranes: diffusion, osmosis, chemically mediated, and active transport. Electric properties of cells: ion transport; equilibrium, resting, and action potentials. Kinetic and molecular properties of single voltage-gated ion channels. Laboratory and computer exercises illustrate the concepts. For juniors and seniors. Students engage in extensive written and oral communication exercises. Meets with graduate subject 6.521j, but assignments differ. 4 Engineering Design Points.
D. M. Freeman, J. Han

6.022j Quantitative Physiology: Organ Transport Systems
(Same subject as 2.792j, 20.371j, HST.542j)
(Subject meets with 2.796j, 6.522j, 20.471j)
Prereq: 18.03, 8.02, or permission of instructor
U (Spring)
4-2-6
Application of the principles of energy and mass flow to major human organ systems. Mechanisms of regulation and homeostasis. Anatomical, physiological and pathophysiological features of the cardiovascular, respiratory and renal systems. Systems, features and devices that are most illuminated by the methods of physical sciences. Laboratory work includes some animal studies. 2 Engineering Design Points.
R. G. Mark, C. M. Stultz

6.023j Fields, Forces and Flows in Biological Systems
(Same subject as 2.793j, 20.330j)
Prereq: 2.005, 6.021, 6.320, or permission of instructor
U (Spring)
4-0-8
See description under subject 20.330j.
J. Han, R. D. Kamm, S. Manalis

6.024j Molecular, Cellular, and Tissue Biomechanics
(Same subject as 2.797j, 3.053j, 20.310j)
Prereq: 18.03 or 3.016; 7.012, 7.013, 7.014, or 7.015; 2.370 or 2.772j
U (Spring)
4-0-8
See description under subject 2.797j.
M. J. Long, R. D. Kamm

6.033 Computer System Engineering
Prereq: 6.004
U (Spring)
5-0-7
Topics on the engineering of computer software and hardware systems: techniques for controlling complexity; strong modularity using client-server design, operating systems; performance, networks; naming; security and privacy; fault-tolerant systems, atomicity and coordination of concurrent activities, and recovery; impact of computer systems on society. Case studies of working systems and readings from the current literature provide comparisons and contrasts. Two design projects. Students engage in extensive written communication exercises. Enrollment may be limited. 4 Engineering Design Points.
M. F. Kaashoek, H. Balakrishnan
6.034 Artificial Intelligence
(Subject meets with HST.947, Spring only)
Prereq: 6.001
U (Fall, Spring)
5-3-4
Introduces representations, techniques, and architectures used to build applied systems and to account for intelligence from a computational point of view. Applications of rule chaining, heuristic search, constraint propagation, constrained search, inheritance, and other problem-solving paradigms. Applications of identification trees, neural nets, genetic algorithms, and other learning paradigms. Speculations on the contributions of human vision and language systems to human intelligence. 4 Engineering Design Points.
P. H. Winston, T. Lozano-Perez

6.035 Computer Language Engineering
Prereq: 6.170
U (Fall)
4-4-4
Analyzes issues associated with the implementation of higher-level programming languages. Fundamental concepts, functions, and structures of compilers. The interaction of theory and practice. Using tools in building software. Includes a multi-person project on compiler design and implementation. 8 Engineering Design Points.
S. P. Amarasinghe

6.041 Probabilistic Systems Analysis
(Subject meets with 6.431)
Prereq: 18.02
U (Fall, Spring)
4-0-8 REST
Credit cannot also be received for 18.05
D. P. Bertsekas, J. N. Tsitsiklis

6.042] Mathematics for Computer Science
(Subject meets with 18.062)
Prereq: 18.01
U (Fall, Spring)
5-0-7 REST
Elementary discrete mathematics for computer science and engineering. Emphasis on mathematical definitions and proofs as well as on applicable methods. Topics: formal logic notation, proof methods; induction, well-ordering; sets, relations; elementary graph theory; integer congruences; asymptotic notation and growth of functions; permutations and combinations, counting principles; discrete probability. Further selected topics such as: recursive definition and structural induction; state machines and invariants; recurrences; generating functions.
A. R. Meyer, T. Leighton

6.045] Automata, Computability, and Complexity
(Subject as 18.400)
Prereq: 6.042
U (Spring)
4-0-8
S. Micali

6.046] Design and Analysis of Algorithms
(Subject as 18.410)
Prereq: 6.006 (alternatively: 6.001; 6.042/18.062 or 18.310)
U (Fall, Spring)
4-0-8
Techniques for the design and analysis of efficient algorithms, emphasizing methods useful in practice. Topics include sorting; search trees, heaps, and hashing; divide-and-conquer; dynamic programming; greedy algorithms; amortized analysis; graph algorithms; and shortest paths. Advanced topics include network flow; computational geometry; number-theoretic algorithms; polynomial and matrix calculations; caching; and parallel computing.
C. E. Leiserson, M. Goemans

6.047] Computational Biology: Genomes, Networks, Evolution
(Subject meets with 6.878)
Prereq: 6.001; 7.012; 18.440 or 6.041
U (Fall)
3-0-9
Covers the algorithmic and machine learning foundations of computational biology, combining theory with practice. Principles of algorithm design, influence problems and techniques, and analysis of large-scale biological datasets. Topics include (a) genomes: sequence analysis, gene finding, RNA folding, genome alignment and assembly, database search; (b) networks: gene expression analysis, regulatory motifs, biological network analysis; (c) evolution: comparative genomics, phylogenetics, genome duplication, genome rearrangements, evolutionary theory. These are coupled with fundamental algorithmic techniques including: dynamic programming, hashing, Gibbs sampling, expectation maximization, hidden Markov models, stochastic context-free grammars, graph clustering, dimensionality reduction, Bayesian networks.
M. Kellis, P. Indyk

6.050] Information, Entropy and Computation
(Subject as 2.110)
Prereq: 8.01, 8.012, 8.01L or 8.01T
U (Spring)
4-0-5
Explores the ultimate limits to communication and computation, with an emphasis on the physical nature of information and information processing. Topics include information and computation, digital signals, codes, and compression. Biological representations of information. Logic circuits, computer architectures, and algorithmic information. Noise, probability, and error correction. The concept of entropy applied to channel capacity and to the second law of thermodynamics. Reversible and irreversible operations and the physics of computation. Quantum computation.
P. Penfield, Jr., S. Lloyd

6.061 Introduction to Electric Power Systems
(Subject meets with 6.690)
Prereq: 6.002, 6.013
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9
J. L. Kirtley, Jr.

6.07] Projects in Microscale Engineering for the Life Sciences
(Subject as HST.410)
Prereq: —
U (Spring)
2-4-3
See description under subject HST.410J.
D. Freeman, M. Gray, A. Aranyosi
6.070 Electronics Project Laboratory
(Same subject as SP.705)
Prereq: —
U (Fall, IAP, Spring)
2-2-2
Introduction to electronics test equipment such as oscilloscopes, meters (voltage, resistance, inductance, capacitance, etc.), and signal generators. Emphasizes individual instruction and development of skills, such as soldering, assembling, and troubleshooting. Students build and keep an electronics kit, such as a radio, to serve as the vehicle for learning about electronics test and measurement equipment. Intended for students without a previous background in electronics. Enrollment may be limited.
E. J. Moriarty

6.071 Introduction to Electronics
(Same subject as 22.071)
Prereq: 18.03
U (Spring)
3-3-6 REST
Introductory subject suitable for students with little or no previous background in electronics. Provides the knowledge necessary for reading schematics and designing, building, analyzing, and testing fundamental analog and digital circuits. The class has a strong hands-on component. Students construct interactive examples and explore the practical uses of electronics in engineering and experimental science, including signals and measurement fundamentals. Students have the use of state-of-the-art hardware and software for data acquisition, analysis, and control.
D. Cory, M. Chaniotakis

6.072 Introduction to Digital Electronics
(Same subject as SP.702)
Prereq: —
U (Fall, IAP, Spring)
0-3-3 [P/D/F]
See description under subject SP.702.
J. Boles

6.080-6.089 Special Subjects in Electrical Engineering and Computer Science
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
6.090–6.099 Special Subjects in Electrical Engineering and Computer Science
Prereq: —
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
6.101 Introductory Analog Electronics Laboratory
Prereq: 6.002 or 6.071
U (Fall)
2-9-1 Institute LAB
Introductory experimental laboratory explores the design, construction, and debugging of analog electronic circuits. Lectures and six laboratory projects investigate the performance characteristics of diodes, transistors, JFETs, and op-amps, including the construction of a small audio amplifier and preamplifier. Seven weeks are devoted to the design and implementation, and written and oral presentation of a project in an environment similar to that of engineering design teams in industry. Provides opportunity to simulate real-world problems and solutions that involve trade-offs and the use of engineering judgment. Engineers from local analog engineering companies come to campus to help students with their design projects. 12 Engineering Design Points.
B. M. Roscoe

6.102 Introductory RF Design Laboratory (New)
Prereq: 6.002 or 6.071
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
2-9-1 Institute LAB
Introductory experimental laboratory focuses on the fundamentals of radio frequency design through the study of radio receiver circuits from 1920 to 1960. Five labs using JFETs (arranged to behave like triodes and pentodes) investigate the behavior of series and parallel tuned circuits, bandwidth control, RF amplifiers, local oscillators, mixers, IF amplifiers, AM and FM detectors, audio stages, and RF measurements. Lecture topics include regenerative receivers and detectors; tuned RF, superhet-erodyne and FM receivers; the “All-American 5” AC-DC AM receiver; and common vacuum tube triode and pentode topologies. Five weeks of the term are devoted to the restoration and circuit analysis of an antique radio supplied by the instructor. 12 Engineering Design Points.
B. M. Roscoe

6.105 Introductory Digital Systems Laboratory
Prereq: 6.002, 6.071, or 16.004
U (Fall, Spring)
3-7-2 Institute LAB
Lectures and labs on digital logic, flip flops, PALs, FPGAs, counters, timing, synchronization, and finite-state machines prepare students for the design and implementation of a digital system. Students implement digital logic designs. Students engage in extensive written and oral communication exercises. 12 Engineering Design Points.
A. P. Chandrakasan, C. J. Terman

6.111 Introductory Digital Systems Laboratory
Prereq: 6.002
U (Spring)
2-9-1 Institute LAB

6.115 Microcomputer Project Laboratory
Prereq: 6.002
U (Spring)
3-6-3 Institute LAB
Introduces the analysis and design of embedded systems. Microcontrollers provide adaptation, flexibility, and real-time control. Emphasis placed on the construction of complete systems, including a five-axis robot arm, a fluorescent lamp ballast, a tomographic imaging station (e.g. a CAT scan), and a simple calculator. A wide
range of basic tools are introduced, including software and development tools, peripheral components such as A/D converters, communication schemes, signal processing techniques, closed-loop digital feedback control, interface and power electronics, and modeling of electromechanical systems. Students complete a sequence of assigned projects, followed by a final project of the student's choice, emphasizing creativity and uniqueness. Final project may be expanded to satisfy a 6.UAP project. 12 Engineering Design Points.

S. B. Leeb

6.121J Bioelectronics Project Laboratory
(Same subject as HST.575J)
Prereq: 6.002 or 6.071
U (Spring)
2-8-2 Institute LAB
Project Laboratory in electronic instrumentation, interfacing the analog and digital world. Students specify design, implement, and evaluate biomedical instruments, including several interrelated analog and digital subsystems. Extensive use of integrated analog circuits and a microprocessor. Classroom development of analytic models for complex functional components and the measurement process in the context of a longitudinal laboratory project. Students engage in extensive written and oral communication exercises. 12 Engineering Design Points.

R. Sarpeshkar, D. M. Freeman, S. K. Burns

6.131 Power Electronics Laboratory
Prereq: 6.002
U (Fall)
3-6-3 Institute LAB
Introduces the design and construction of power electronic circuits and motor drives. Laboratory exercises include the construction of drive circuitry for an electric go-cart, flash strobes, computer power supplies, three-phase inverters for AC motors, and resonant drives for lamp ballasts and induction heating. Basic electric machines introduced include DC, induction, and permanent magnet motors, with drive considerations. Final project may be expanded to serve as a 6.UAP project, with instructor permission. 12 Engineering Design Points.

S. B. Leeb, J. L. Kirtley, Jr.

6.141J Robotics: Science and Systems I
(Same subject as 16.415J)
Prereq: Permission of instructor
U (Spring)
2-6-4 Institute LAB
Presents concepts, principles, and algorithms for computation and action in the physical world. Topics covered are: motion planning; geometric reasoning; kinematics and dynamics; state estimation; tracking; map building; manipulation; human-robot interaction; fault diagnosis; and embedded system development. Students specify and design a small scale yet complex robot capable of real time interaction with the natural world. Students may continue content in 6.142. Prior knowledge of one or more of the following areas would be useful: control (2.004 or 16.30); software (1.00 or 6.170 or 16.35); electronics (6.002 or 6.070 or 6.111 or 6.115); mechanical engineering (2.007); or independent experience such as MasLAB, 6.270 or a relevant UROP. Enrollment limited. 12 Engineering Design Points.

J. Leonard, U. O'Reilly, N. Roy, D. Rus, S. Teller

6.142J Robotics: Science and Systems II
(Same subject as 16.416J)
Prereq: 6.141 or permission of instructor
U (Fall)
2-6-4
Implementation and operation of the embedded system designed in 6.141. Addresses open research issues such as sustained autonomy, situational awareness, and human interaction. Students carry out experiments to assess their design and deliver a final written report. Prior knowledge of one or more of the following areas would be useful: control (2.004 or 16.30), software (1.00, 6.170 or 16.35), electronics (6.002, 6.070, 6.111 or 6.115), mechanical engineering (2.007), independent experience (MasLAB, 6.270 or a UROP). 12 Engineering Design Points.

J. Leonard, U. O'Reilly, N. Roy, D. Rus, S. Teller

6.152J Micro/Nano Processing Technology
(Same subject as 3.155J)
Prereq: Permission of instructor
U (Fall, Spring)
3-4-5
Introduces the theory and technology of micro/nano fabrication. Lectures and laboratory sessions on basic processing techniques such as vacuum processes, lithography, diffusion, oxidation, and pattern transfer. Students fabricate MOS capacitors, nanomechanical cantilevers, and microfluidic mixers. Emphasis on the interrelationships between material properties and processing, device structure, and the electrical, mechanical, optical, chemical or biological behavior of devices. Provides background for thesis work in micro/nano fabrication or for 6.151. Students engage in extensive written and oral communication exercises. 6 Engineering Design Points.

M. A. Schmidt, L. A. Kolodziejski, R. C. O'Handley, C. A. Ross

6.161 Modern Optics Project Laboratory
(Subject meets with 6.637)
Prereq: 6.003; 6.013 or 8.03 recommended
U (Fall)
3-5-4 Institute LAB
Lectures, laboratory exercises and projects on optical signal generation, transmission, detection, storage, processing and display. Topics include polarization properties of light; reflection and refraction; coherence and interference; Fraunhofer and Fresnel diffraction; holography; Fourier optics; coherent and incoherent imaging and signal processing systems; optical properties of materials; lasers and LEDs; electro-optic and acousto-optic light modulators; photorefractive and liquid-crystal light modulation; display technologies; optical waveguides and fiber-optic communication systems; photodetectors. Students may use this subject to find an advanced undergraduate project. Students engage in extensive oral and written communication exercises. 12 Engineering Design Points.

C. Warde

6.163 Strobe Project Laboratory
Prereq: 8.02 or permission of instructor
U (Fall, Spring)
2-8-2 Institute LAB
Application of electronic flash sources to measurement and photography. First half covers fundamentals of photography and electronic flashes, including experiments on application of electronic flash to photography, stroboscopy, motion analysis, and high-speed videography. Students write five extensive lab reports. In the second half, students work in small groups to select, design, and execute independent projects in measurement or photography that apply learned techniques. Project planning and execution skills are discussed and developed over the term. Enrollment limited. 12 Engineering Design Points.

J. K. Vandiver, J. W. Bales

6.170 Laboratory in Software Engineering
Prereq: 6.001 or 6.005
U (Fall, Spring)
3-9-3
Introduces concepts and techniques relevant to the production of large software systems. Students taught a programming method based on the recognition and description of useful abstractions. Topics: modularity; specification; data abstraction; object modeling; design patterns; and testing. Several programming projects of varying size undertaken by students working individually and in groups. Enrollment may be limited. 12 Engineering Design Points.

B. H. Liskov, D. N. Jackson
6.171 Software Engineering for Web Applications
Prereq: 6.001, 6.170
U (Spring)
3-6-3

Computation over unreliable and anonymous protocols such as that of the web. Problems of persistence, concurrency control, transactions, and transactions across multiple servers. The relational database management system as a tool for attacking these problems. Students work in small mentored teams on diverse projects. Enrollment limited. 12 Engineering Design Points.
H. Abelson

6.182 Psychoacoustics Project Laboratory
Prereq: —
U (Spring)
3-6-3 Institute LAB

Introduces the methods used to measure human auditory abilities. Discusses auditory function, principles of psychoacoustic measurement, models for psychoacoustic performance, and experimental techniques. Project topics: absolute and differential auditory sensitivity, operating characteristics of human observers, span of absolute judgment, adaptive measurement procedures, and scaling sensory magnitudes. Knowledge of probability helpful. Students engage in extensive written and oral communication exercises. 12 Engineering Design Points.
L. D. Braida

6.185–6.190 Special Laboratory Subjects in Electrical Engineering and Computer Science
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Laboratory subjects not offered in the regular curriculum. Consult department to learn offerings for a particular term.
G. C. Verghese

SENIOR PROJECTS

6.193–6.197 Special Laboratory Subjects in Electrical Engineering and Computer Science
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Laboratory subjects not offered in the regular curriculum. Consult department to learn offerings for a particular term. Registration by permission of instructor.
G. C. Verghese

6.198 Undergraduate Advanced Project
Prereq: 6.UAP
U (Fall, Spring)
0-6-0
Can be repeated for credit

Research project for students completing the SB degree, to be arranged by the student and an appropriate MIT faculty member. Students who register for this subject must consult the department undergraduate office. Students engage in extensive written communications exercises.
A. C. Smith

6.231 Dynamic Programming and Stochastic Control
Prereq: 6.041 or 18.313; 18.100
G (Fall)
3-0-9 H-LEVEL Grad Credit

D. P. Bertsekas

6.241 Dynamic Systems and Control
Prereq: 6.003, 18.06
G (Fall)
4-0-8 H-LEVEL Grad Credit

M. A. Dahleh, A. Megretski, G. C. Verghese

6.242 Advanced Linear Control Systems
Prereq: 18.06, 6.241
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

M. A. Dahleh, A. Megretski

6.243] Dynamics of Nonlinear Systems
(Same subject as 16.337)
Prereq: 18.100, 6.241
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

J. L. Wyatt, Jr., A. Megretski, M. Dahleh, R. Ramnath
6.253 Convex Analysis and Optimization
Prereq: 18.06, 18.100
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Core analytical issues of continuous optimization, duality, and saddle point theory, and development using a handful of unifying principles that can be easily visualized and readily understood. The mathematical theory of convex sets and functions is discussed in detail, and it is the basis for an intuitive, highly visual, geometrical approach to the subject. Alternate years.
D. P. Bertsekas

6.254 Game Theory with Engineering Applications
Prereq: 6.041
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduction to fundamentals of game theory and mechanism design with motivations for each topic drawn from engineering applications (including distributed control of wireline/wireless communication networks, transportation networks, pricing). Emphasis on the foundations of the theory, mathematical tools, as well as modeling and the equilibrium notion in different environments. Topics include normal form games, supermodular games, dynamic games, repeated games, games with incomplete/imperfect information, mechanism design, cooperative game theory, and network games.
A. Ozdaglar

6.255 Optimization Methods
(Same subject as 15.093J)
Prereq: 18.06
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 15.093J.
D. Bertsimas, P. Parrilo

6.256 Discrete Stochastic Processes
Prereq: 6.041, 6.431 or 18.313
G (Spring)
3-0-9 H-LEVEL Grad Credit
Review of probability and laws of large numbers; Poisson counting process and renewal processes; Markov chains (including Markov decision theory), branching processes, birth-death processes, and semi-Markov processes; continuous-time Markov chains and reversibility; random walks, martingales, and large deviations; applications from queueing, communication, control, and operations research.
R. G. Gallager, J. L. Wyatt

6.263 Data-Communication Networks
(Same subject as 16.37J)
Prereq: 6.041 or 18.313
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Modeling of the control processes in conventional and high-speed data communication networks. Develops and utilizes elementary concepts from queueing theory, algorithms, linear and nonlinear programming to study the problems of line and network protocols, distributed algorithms, quasi-static and dynamic routing, congestion control, deadlock prevention. Treats local and wide-area networks, and high-speed electronic and optical networks.
D. P. Bertsekas, E. Modiano

6.264J Queues: Theory and Applications
(Same subject as 15.072J)
Prereq: 6.262
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 15.072J.
D. Bertsimas, D. Gamarnik, J. N. Tsitsiklis

6.281 Logistical and Transportation Planning Methods
(Same subject as 1.203J, 15.073J, 16.76J, ESD.216J)
Prereq: 6.431
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.203J.
R. C. Larson, A. R. Odoni, A. I. Barnett

6.282J Quantitative Foundations of Engineering Systems
(Same subject as ESD.772J)
Prereq: 6.041
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.772J.
S. Mitter, D. Shah

6.291 Seminar in Systems, Communications, and Control Research
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Advanced topics in systems, communications, control, and signal processing. Selected topics according to student and instructor interest. See instructor for specific topics to be offered in a particular term.
S. K. Mitter
Electronics, Computers, and Systems

6.301 Solid-State Circuits
Prereq: 6.012, 6.003
G (Fall)
4-2-6
Analysis and design of transistor circuits, based directly on the semiconductor physics and transistor circuit models developed in 6.012. High-frequency and low-frequency design calculations and simulation of multistage transistor circuits. Trans-linear circuits. The charge-control model. Introduction to operational-amplifier design and application. Some previous laboratory experience assumed. 4 Engineering Design Points.

J. K. Roberge, H. S. Lee

6.302 Feedback Systems
Prereq: 6.003, 2.003, or 16.04
G (Spring)
4-2-6

J. K. Roberge

6.331 Advanced Circuit Techniques
Prereq: 6.301, 6.302; permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
4-2-6 H-LEVEL Grad Credit
Following a brief classroom discussion of relevant principles, each student completes the paper design of several advanced circuits such as multiplexers, sample-and-holds, gain-controlled amplifiers, analog multipliers, digital-to-analog or analog-to-digital converters, and power amplifiers. One of each student’s designs is presented to the class, and one may be built and evaluated. Associated laboratory emphasizing the use of modern analog building blocks. Alternate years. Enrollment limited. 12 Engineering Design Points.

J. K. Roberge

6.334 Power Electronics
Prereq: 6.012
G (Spring)
3-0-9 H-LEVEL Grad Credit
The application of electronics to energy conversion and control. Modeling, analysis, and control techniques. Design of power circuits including inverters, rectifiers, and dc-dc converters. Analysis and design of active components and filters. Characteristics of power semiconductor devices. Numerous application examples, such as motion control systems, power supplies, and radio-frequency power amplifiers. 6 Engineering Design Points.

J. G. Kassakian, D. Perreault

6.336 Introduction to Numerical Simulation (Same subject as 2.096J, 6.910J)
Prereq: 18.03 or 18.06
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to computational techniques for the simulation of a large variety of engineering and engineered systems. Applications drawn from aerospace, mechanical, electrical, and chemical engineering, biology, and materials science. Topics: mathematical formulations; network problems; sparse direct and iterative matrix solution techniques; Newton methods for nonlinear problems; discretization methods for ordinary, time-periodic and partial differential equations; fast methods for partial differential equations and integral equations, techniques for model order reduction of dynamical systems and approaches for molecular dynamics.


6.337 Introduction to Numerical Methods for Partial Differential Equations
(Same subject as 2.097J, 16.920J)
Prereq: 18.03 or 18.06
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 16.920J.

D. L. Darmofal, A. T. Patera, J. K. White

6.338 Parallel Computing (Same subject as 18.337J)
Prereq: 18.06
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 18.337J.

P.-O. Persson

6.339 Discrete-Time Signal Processing
Prereq: 6.011
G (Fall)
4-0-8 H-LEVEL Grad Credit

A. V. Oppenheim, V. K. Goyal

6.342 Wavelets, Approximation, and Compression
Prereq: 18.06; 6.341 or 6.450
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Study topics including Hilbert space formulation of continuous-time and discrete-time signals; sampling; orthogonal and biorthogonal signal expansions; uncertainty principles and the time-frequency plane; two-channel filter banks, iterated filter banks, discrete wavelet transforms, multiresolution analysis, wavelet bases, regularity, approximation properties, and nonlinear approximation; basics of quantization and source coding; compression, denoising, and other image processing using wavelets. Advanced topics from the current research literature. Alternate years.

V. K. Goyal

6.344 Digital Image Processing
Prereq: 6.003, 6.041
G (Spring)
3-0-9 H-LEVEL Grad Credit
Digital images as two-dimensional signals. Digital signal processing theories used for digital image processing, including one-dimensional and two-dimensional convolution, Fourier transform, discrete Fourier transform, and discrete cosine transform. Image processing basics. Image enhancement. Image restoration. Image coding
and compression. Video processing including video coding and compression. Additional topics including digital high-definition television systems.

J. S. Lim

6.345j Automatic Speech Recognition
(One subject as HST.728j)
Prereq: 6.003, 6.041
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-1-8 H-LEVEL Grad Credit

Graduate-level introduction to automatic speech recognition. Provide fundamental background in acoustic theory of speech production, properties of speech sounds, signal representation, acoustic modeling, pattern classification, search algorithms, stochastic modeling techniques (including hidden Markov modeling), and language modeling. Advanced topics include finite-state transducer formulation for speech recognition, system robustness and adaptation, audio-visual integration for speech processing, and speech understanding. Hands-on experience gained through laboratory exercises and a term project. Alternate years. 4 Engineering Design Points.

V. W. Zue, J. R. Glass

6.374 Analysis and Design of Digital Integrated Circuits
Prereq: 6.012, 6.004
G (Fall)
3-3-6 H-LEVEL Grad Credit

Device and circuit level optimization of digital building blocks. MOS device models including Deep Sub-Micron effects. Circuit design styles for logic, arithmetic and sequential blocks. Estimation and minimization of energy consumption. Interconnect models and parasitics; device sizing and logical effort; timing issues (clock skew and jitter) and active clock distribution techniques. Memory architectures, circuits (sense amplifiers) and devices. Testing of integrated circuits. Extensive use of circuit layout and SPICE in design projects and software labs. 4 Engineering Design Points.

A. P. Chandrakasan

6.375 Complex Digital Systems Design
Prereq: 6.004
G (Spring)
5-5-2 H-LEVEL Grad Credit

Introduction to the design and implementation of large-scale digital systems using CMOS VLSI: technology and scaling; VLSI implementation styles—full custom to FPGAs; design flows and associated EDA tools; design verification; design for fabrication testing; hardware description languages (Verilog & Bluespec); power, area and delay optimizations; clocking schemes; power distribution and dissipation; I/O and packaging. Extensive use of CAD tools in weekly labs as preparation for a multi-person design project on multi-million gate FPGAs. Enrollment may be limited.

Arvind, K. Asanovic

6.376 Low Power Analog VLSI
Prereq: 6.301
G (Fall)
4-0-8 H-LEVEL Grad Credit


R. Sarpeshkar

Probabilistic Systems and Communication

6.431 Applied Probability
(Subject meets with 6.041)
Prereq: 18.02
G (Fall, Spring)
4-0-8

Meets with undergraduate subject 6.041.

Requires the completion of additional advanced home problems.

D. P. Bertsekas, J. N. Tsitsiklis

6.434j Statistics for Engineers and Scientists
(Same subject as 16.391j)
Prereq: 18.02, 18.06, 6.431, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Provides a rigorous introduction to fundamentals of statistics motivated by engineering applications and emphasizing the informed use of modern statistical software. Topics include sufficient statistics, exponential families, estimation, hypothesis testing, measures of performance, and notion of optimality. Alternate years.

M. Win, J. N. Tsitsiklis

6.435 System Identification
Prereq: 6.241, 6.432
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Mathematical models of systems from observations of their behavior. Time series, state-space, and input-output models. Model structures, parameterization, and identifiability. Non-parametric methods. Prediction error methods for parameter estimation, convergence, consistency, and asymptotic distribution. Relations to maximum likelihood estimation. Recursive estimation; relation to Kalman filters; structure determination; order estimation; Akaikie criteria; and bounded but unknown noise models. Robustness and practical issues. Alternate years.

M. A. Dahleh, S. K. Mitter

6.436j Fundamentals of Probability
(Same subject as 15.085j)
Prereq: 18.02
G (Fall)
4-0-8 H-LEVEL Grad Credit


J. N. Tsitsiklis, D. Bertsimas

6.437 Inference and Information
Prereq: 6.041/6.431 or 6.436j
G (Spring)
4-0-8 H-LEVEL Grad Credit

Introduction to principles of Bayesian and non-Bayesian statistical inference. Hypothesis testing and parameter estimation, sufficient statistics; exponential families. Log-loss inference criterion, entropy and model capacity. Kullback-Leibler distance and information geometry. Asymptotic analysis and large deviations theory. Model order estimation; nonparametric statistics. Computational issues and approximation techniques; Monte Carlo methods. Selected special topics such as universal prediction and compression.

P. Golland, A. S. Willsky, G. W. Wornell
6.438 Algorithms for Estimation and Inference
(New)
Prereq: 6.011 and 18.06
G (Fall)
4-0-8 H-LEVEL Grad Credit
R. Golland, A. S. Willsky, G. W. Wornell

6.441 Information Theory
Prereq: 6.041
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduction to the quantitative theory of information and its applications to reliable, efficient communication systems. Mathematical definition and properties of information and its operational meanings. Basics of large deviations and its use in information theory, coding theory, and statistics. Source coding theorem and noisy channel coding theorem; error exponents; the source-channel separation theorem; multiple access channels, broadcast channels. Readings from the literature in these topics.
M. Medard, L. Zheng

6.442 Optical Networks
Prereq: 6.041, 6.042
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduces the fundamental and practical aspects of optical network technology, architecture, design and analysis tools and techniques. The treatment of optical networks are from the architecture and system design points of view. Optical hardware technologies introduced and characterized as fundamental network building blocks on which optical transmission systems and network architectures are based. In addition to the Physical Layer, the higher network layers (Media Access Control, Network and Transport Layers) are considered together as integral parts of network design. Performance metrics, analysis and optimization techniques are developed to help guide the creation of high performance complex optical networks.
V. W. S. Chan

6.443J Quantum Information Science
(Same subject as 8.371J, MAS.865J)
Prereq: 2.11 or 8.05; 6.050J or 18.06
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject MAS.865J.
I. Chuang

6.450 Principles of Digital Communication I
Prereq: 6.011
G (Fall)
3-0-9 H-LEVEL Grad Credit
Communication sources and channels; data compression; entropy and the AEP; Lempel-Ziv universal coding; scalar and vector quantization; L2 waveforms; signal space and its representation by sampling and other expansions; aliasing; the Nyquist criterion; PAM and QAM modulation; Gaussian noise and random processes; detection and optimal receivers; fading channels and wireless communication; introduction to communication system design.
R. G. Gallager, L. Zheng

6.451 Principles of Digital Communications II
Prereq: 6.450
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Coding for the AWGN channel; the gap to capacity; binary block and convolutional codes; finite fields and Reed-Solomon codes; trellis representations; codes on graphs and iterative decoding; capacity-approaching codes; lattice and trellis codes. Alternate years.
G. D. Forney

6.452 Principles of Wireless Communication
Prereq: 6.450
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduction to design, analysis, and fundamental limits of wireless transmission systems. Wireless channel and system models; fading and diversity; resource management and power control; multiple-antenna and MIMO systems; space-time codes and decoding algorithms; multiple-access techniques and multiuser detection; broadcast codes and precoding; cellular and ad-hoc network topologies; OFDM and ultrawideband systems; architectural issues.
G. W. Wornell, L. Zheng

6.453 Quantum Optical Communication
Prereq: 6.011 and 18.06
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Quantum optics: Dirac notation quantum mechanics; harmonic oscillator quantization; number states, coherent states, and squeezed states; radiation field quantization and quantum field propagation; P-representation and classical fields. Linear loss and linear amplification: commutator preservation and the Uncertainty Principle; beam splitters; phase-insensitive and phase-sensitive amplifiers. Quantum photodetection: direct detection, homodyne detection, and heterodyne detection. Second-order nonlinear optics: phasematched interactions; optical parametric amplifiers; generation of squeezed states, photon-twin beams, non-classical fourth-order interference, and polarization entanglement. Quantum systems theory: optimum binary detection; quantum precision measurements; quantum cryptography; and quantum teleportation. Term paper required. Alternate years.
J. H. Shapiro

6.454 Graduate Seminar in Area I
Prereq: Permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Student-run advanced graduate seminar covering topics in Area I (communications, signal processing, optimization and control). Participants give presentations outside of their own research to expose colleagues to topics not covered in the usual curriculum. Recent topics have included information geometry, linear programming decoding, biology in EECS, distributed hypothesis testing and cryptography. Open to advanced students who have completed their Area I TQE graduate subjects. Enrollment limited to 12 students.
L. Zheng, D. Shah

6.455J Sonar, Radar, and Seismic Signal Processing
(Same subject as 2.686J, 12.518J)
Prereq: 2.004 or 6.003; 6.041; 18.075 or 18.085
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.686J.
N. C. Makris, J. C. Preisig, Woods Hole Staff
Bioelectrical Engineering

6.521] Quantitative Physiology: Cells and Tissues
(Same subject as 2.794J, 20.470J, HST.541J)
(Subject meets with 2.791J, 6.021J, 20.370J)
Prereq: 2.003, 6.002, 6.071, or 10.301; 8.02, 18.03
G (Fall)
5-2-5
See description under subject 6.021.
D. M. Freeman, J. Han

(Same subject as 2.796J, 20.471J)
(Subject meets with 2.792J, 6.022J, 20.371J, HST.542J)
Prereq: 2.006 or 6.013; 6.021J
G (Spring)
4-2-6
Meets with undergraduate subject 6.022J. Requires the completion of more advanced home problems and/or an additional project.
R. G. Mark

6.524] Molecular, Cellular, and Tissue Biomechanics
(Same subject as 2.798J, 3.971J, 10.537J, 20.410J)
Prereq: 7.012; 2.002, 2.006, 6.013, 6.014, 10.301, or 10.302
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.410J.
A. J. Grodzinsky, P. Doyle, S. Suresh

6.542] Laboratory on the Physiology, Acoustics, and Perception of Speech
(Same subject as 24.966J, HST.712J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
2-2-8 H-LEVEL Grad Credit
Experimental investigations of speech processes. Topics: measurement of articulatory movements; measurements of pressures and airflows in speech production; computer-aided waveform analysis and spectral analysis of speech; synthesis of speech; perception and discrimination of speechlike sounds; speech prosody; models for speech recognition; speech development; and other topics. Recommended prerequisites: 6.002 or 18.03. Alternate years. 4 Engineering Design Points.
K. N. Stevens, J. S. Perkell, S. Shattuck-Hufnagel

6.543] The Lexicon and Its Features
(Same subject as 9.587J, 24.941J, HST.727J)
Prereq: 24.901 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 24.941J.
D. Gow, D. Steriade, K. N. Stevens, S. Shattuck-Hufnagel

6.551] Acoustics of Speech and Hearing
(Same subject as HST.714J)
Prereq: 8.03 and 6.003; or permission of instructor
G (Fall)
4-1-7 H-LEVEL Grad Credit
Provides acoustical background necessary to understand the role of sound in speech communication. Analyzes constraints imposed by the properties of sound and human anatomy on speech production (sound production from airflow and filtering by the vocal tract); auditory physiology (transformation of acoustical waves in the air to mechanical vibrations of cochlear structures); and sound perception (spatial hearing, masking, and auditory frequency selectivity). 4 Engineering Design Points.
L. D. Braida, J. J. Rosowski, C. Shera, K. N. Stevens

6.552] Signal Processing by the Auditory System: Perception
(Same subject as HST.716J)
Prereq: 6.003; 6.041 or 6.431; or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Studies behavioral aspects of human hearing in relation to current physiological knowledge. Examines performance in processing information from acoustic stimuli. Correlations between behavior and physiology, reflecting the tono-topic organization and stochastic responses of the auditory system. Mathematical models of psychophysical relations, incorporating quantitative knowledge of physiological transformations by the peripheral auditory system. Discusses related research on diagnosis and aids for the partially deaf. Alternate years.
L. D. Braida

6.555] Biomedical Signal and Image Processing
(Same subject as 16.456J, HST.582J)
Prereq: 6.003, 2.004, 16.004, or 18.085
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject HST.582J.

6.556] Data Acquisition and Image Reconstruction in MRI
(Same subject as HST.580J)
Prereq: 6.011
G (Fall)
3-0-9 H-LEVEL Grad Credit
Applies analysis of signals and noise in linear systems, sampling, and Fourier properties to magnetic resonance (MR) imaging acquisition and reconstruction. Provides adequate foundation for MR physics to enable study of RF excitation design, efficient Fourier sampling, parallel encoding, reconstruction of non-uniformly sampled data, and the impact of hardware imperfections on reconstruction performance. Surveys active areas of MR research. Assignments include Matlab-based work with real data. Includes visit to a scan site for human MR studies.
E. Adalsteinsson
6.561J Fields, Forces, and Flows in Biological Systems
(Same subject as 2.795J, 10.539J, 20.430J, HST.544J)
Prereq: 6.013, 2.005, 10.302, or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.430J.

A. J. Grodzinsky, R. D. Kamm

6.566J Biosensors, Signal Processing, and Biomedical Applications
(Same subject as HST.585J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit
See description under subject HST.585J.
J. C. Weaver, S. K. Burns

(Same subject as 20.482J)
Prereq: 6.021J, 6.034, 6.046, 6.336J, 7.91J, 18.417, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Describes and illustrates computational approaches to solving problems in systems biology. A series of case studies demonstrates how an effective match between the statement of a biological problem and the selection of an appropriate algorithm or computational technique can lead to fundamental advances. Covers several discrete and numerical algorithms used in simulation, feature extraction and optimization for molecular, network, and systems models in biology.
B. Tidor; J. K. White

6.582J Introduction to Molecular Simulations
(Same subject as HST.557J)
Prereq: 6.581J, 7.91J, 18.417J, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to the basic concepts underlying dynamical simulations of proteins and nucleic acids. Topics include classical statistical thermodynamics for calculation of macroscopic observables, normal-mode analyses of protein dynamics, and thermodynamic perturbation theory. Emphasizes actual techniques and algorithms used for such calculations. Final project integrates these concepts in addressing a problem of biological importance using existing molecular mechanics software packages.
C. M. Stultz

6.602 Fundamentals of Photonics (New)
(Same subject as 6.621)
Prereq: 6.003; 6.013 or 8.07
U (Spring)
4-0-8
Fundamentals of optical and optoelectronic phenomena and devices based on classical and quantum properties of radiation and matter, culminating in lasers and applications. Fundamentals include Maxwell’s electromagnetic waves, resonators and beams, classical ray optics and optical systems, quantum theory of light, matter and its interaction, classical and quantum noise, lasers and laser dynamics, continuous wave and short pulse generation, light modulation; examples from integrated optics, semiconductor optoelectronics and nonlinear optics.
F. X. Kaertner

6.621 Fundamentals of Photonics (New)
(Same subject as 6.602)
Prereq: 6.003; 6.013, 8.07, or 6.630
G (Spring)
4-0-8 H-LEVEL Grad Credit
Meets with undergraduate subject 6.602, but requires the completion of additional homework assignments. See subject description under 6.602.
F. X. Kaertner

6.630 Electromagnetics
Prereq: 18.03, 8.02
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to electromagnetics, emphasizing fundamental concepts and applications of Maxwell equations. Topics include polarization, dipole antennas, wireless communications, forces and energy, phase matching, dielectric waveguides and optical fibers, transmission line theory and circuit concepts, antennas, and equivalence principle. Examples deal with electrodynamic propagation, guidance, and radiation of electromagnetic waves.
J. A. Kong

6.631 Optics and Photonics
Prereq: 6.013 or 8.07
G (Fall)
3-0-9 H-LEVEL Grad Credit
J. G. Fujimoto

6.632 Electromagnetic Wave Theory
Prereq: 6.013, 6.630, or 8.07
G (Spring)
3-0-9 H-LEVEL Grad Credit
Emphasis on mathematical approaches, problem solving, and physical interpretation. Topics include: waves in media, equivalence principle, duality and complementarity, Huygens’ principle, Fresnel and Fraunhofer diffraction, dyadic Green’s functions, Lorentz transformation, and Maxwell-Minkowski theory. Examples deal with limiting cases of Maxwell’s theory and diffraction and scattering of electromagnetic waves.
J. A. Kong

6.634J Nonlinear Optics
(Same subject as 8.431J)
Prereq: 6.013 or 8.07
G (Spring)
3-0-9 H-LEVEL Grad Credit
E. P. Ippen, J. G. Fujimoto

6.635J Topics in Electromagnetism
Prereq: 6.013, 6.630, or 6.632
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Topics covered include special relativity, electrodynamics of moving media, waves in dispersive media, microstrip integrated circuits, quantum optics, remote sensing, radiative transfer theory,
scattering by rough surfaces, effective permittivities, and random media. Alternate years.

J. A. Kong

6.637 Optical Signals, Devices, and Systems
(Subject meets with 6.161)
Prereq: 6.003; 6.013 or 8.03 recommended
G (Fall)
3-0-9 H-LEVEL Grad Credit

Principles of operation and applications of devices and systems for optical signal generation, transmission, detection, storage, processing and display. Topics include review of the basic properties of electromagnetic waves; coherence and interference; diffraction and holography; Fourier optics; coherent and incoherent imaging and signal processing systems; optical properties of materials; lasers and LEDs; electro-optic and acousto-optic light modulators; photorefractive and liquid-crystal light modulation; spatial light modulators and displays; optical waveguides and fiber-optic communication systems; photodetectors; 2-D and 3-D optical storage technologies; adaptive optical systems; role of optics in next-generation computers. Student research paper on a specific contemporary topic required.

C. Worde

6.638 Ultrafast Optics
Prereq: 6.630 or 6.631
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit


F. X. Kaertner

6.641 Electromagnetic Fields, Forces, and Motion
Prereq: 6.013
G (Spring)
4-0-8 H-LEVEL Grad Credit

Electric and magnetic quasistatic forms of Maxwell’s equations applied to dielectric, conduction, and magnetization boundary value problems. Electromagnetic forces, force densities, and stress tensors, including magnetization and polarization. Thermodynamics of electromagnetic fields, equations of motion, and energy conservation. Applications to synchronous, induction, and commutator machines; sensors and transducers; microelectromechanical systems; propagation and stability of electromechanical waves; and charge transport phenomena.

M. Zahn, J. H. Lang

6.642 Continuum Electromechanics
Prereq: 6.641 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit


M. Zahn

6.651J Introduction to Plasma Physics I
(Same subject as 8.613J, 22.611J)
Prereq: 6.013, 8.07, or 22.105; 18.04 or 18.075
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 22.611J.
R. Parker, I. Hutchinson, J. Freidberg

6.652J Introduction to Plasma Physics II
(Same subject as 8.614J, 22.612J)
Prereq: 6.651J, 8.613J, or 22.611J
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 8.614J.

Staff

6.661J Receivers, Antennas, and Signals
(Same subject as ESD.66J)
Prereq: 6.013 or 8.03, 6.003, 16.04, or 2.004
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit


D. H. Staelin

6.673 Introduction to Numerical Simulation in Electrical Engineering
Prereq: 6.012 or 6.013
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Selection of a simulation model and physical approximations. Solution of nonlinear coupled PDEs in 1-D through finite difference and finite element methods, Newton’s method, and variants. Finite difference and finite element methods in 2-D and sparse matrix methods emphasizing conjugate gradient algorithms. Semiconductor devices used as primary examples; additional examples drawn from E&M modeling, nonlinear pulse propagation, and laser physics. Alternate years.

P. L. Hagelstein

6.685 Electric Machines
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit


J. L. Kirtley, Jr.

6.690 Introduction to Electric Power Systems
(Subject meets with 6.061)
Prereq: 6.002, 6.013
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Meets with 6.061. Requires the completion of additional advanced home problems. See description under subject 6.061.

J. L. Kirtley, Jr.
6.691 Seminar in Electric Power Systems
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Planning and operation of modern electric power systems. Content varies with current interests of instructor and class; emphasis on engineering aspects, but economic issues may be examined. Core topics include overview of power system structure and operation; representation of components, including transmission lines, transformers, generating plants, loads; power flow analysis, dynamics and control of multimachine systems, steady-state and transient stability, system protection; economic dispatch; mobil and isolated power systems; computation and simulation. Alternate years.
J. L. Kirtley, Jr.

Solid-State Materials and Devices

6.701 Introduction to Nano Electronics (New)
(Subject meets with 6.719)
Prereq: 6.003
G (Spring)
4-0-8
Quantization, wavefunctions and Schrödinger’s equation. Introduction to electronic properties of molecules, carbon nanotubes and crystals. Energy band formation and the origin of metals, insulators and semiconductors. Ballistic transport, Ohm’s law, ballistic versus traditional MOSFETs, fundamental limits to computation.
M. A. Baldo

6.719 Nano Electronics (New)
(Subject meets with 6.701)
Prereq: 6.003
G (Spring)
4-0-8
Meet with 6.701, but requires the completion of additional/different homework assignments and or projects. See subject description under 6.701.
M. A. Baldo

6.720 Integrated Microelectronic Devices
(Same subject as 3.43)
Prereq: 6.012 or 3.42
G (Fall)
4-0-8 H-LEVEL Grad Credit
The physics of microelectronic semiconductor devices for silicon integrated circuit applications. Topics: semiconductor fundamentals, p-n junction, metal-oxide semiconductor structure, metal-semiconductor junction, MOS field-effect transistor, and bipolar junction transistor. Emphasis on physical understanding of device operation through energy band diagrams and short-channel MOSFET device design. Issues in modern device scaling outlined. Includes device characterization projects and device design project. 2 Engineering Design Points.
J. A. del Alamo, H. L. Tuller

6.728 Applied Quantum and Statistical Physics
Prereq: 6.003, 18.06
G (Fall)
4-0-8 H-LEVEL Grad Credit
Elementary quantum mechanics and statistical physics. Introduces applied quantum physics. Emphasizes experimental basis for quantum mechanics. Applies Schrodinger’s equation to the free particle, tunneling, the harmonic oscillator, and hydrogen atom. Variational methods. Elementary statistical physics; Fermi-Dirac, Bose-Einstein, and Boltzmann distribution functions. Simple models for metals, semiconductors, and devices such as electron microscopes, scanning tunneling microscope, thomonic emitters, atomic force microscope, and more.
P. L. Hagelstein, T. P. Orlando, V. Bulovic, K. Berggren

6.729 Molecular Electronics
Prereq: 6.728
G (Fall)
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Applications and aspects of the theory of molecular-scale electronics. Molecular circuit architectures and devices. Optical and electronic properties of molecules are discussed, including radiationless transitions and energy transfer, the ramifications of molecular conformation changes, charge transport in organic molecular crystals and disordered films, metal/organic interfaces, and charge conduction through single molecules. Discussion of molecular circuits in biology. This is an advanced topics subject. A text, supplementary material, and references are provided. Alternate years.
M. Baldo

6.730 Physics for Solid-State Applications
Prereq: 6.013, 6.728
G (Spring)
5-0-7 H-LEVEL Grad Credit
Classical and quantum models of electrons and lattice vibrations in solids, emphasizing physical models for elastic properties, electronic transport, and heat capacity. Crystal lattices, electronic energy band structures, phonon dispersion relations, effective mass theorem, semiclassical equations of motion, electron scattering and semiconductor optical properties. Band structure and transport properties of selected semiconductors. Connection of quantum theory of solids with quasi-Fermi levels and Boltzmann transport used in device modeling.
T. P. Orlando, R. Ram

6.731 Semiconductor Optoelectronics: Theory and Design
Prereq: 6.728, 6.012
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Focuses on the physics of the interaction of photons with semiconductor materials. The band theory of solids is used to calculate the absorption and gain of semiconductor media. The rate equation formalism is used to develop the concepts of laser threshold, population inversion and modulation response. Matrix methods and coupled mode theory are applied to resonator structures such as distributed feedback lasers, tunable lasers and microring devices. The course is also intended to introduce students to noise models for semiconductor devices and to applications of optoelectronic devices to fiber optic communications. Alternate years.
R. J. Ram

6.732 Physics of Solids
Prereq: 6.730 or 8.231
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
4-0-8 H-LEVEL Grad Credit
Continuation of 6.730 emphasizing applications-related physical issues in solids. Topics: electronic structure and energy band diagrams of semiconductors, metals, and insulators; Fermi surfaces; dynamics of electrons; classical diffusive transport phenomena such as electrical and thermal conduction and thermoelectric phenomena; quantum transport in tunneling and ballistic devices; optical properties of metals, semiconductors, and insulators; photon-lattice interactions; optical devices based on intersubband transitions; magnetic properties of solids; exchange energy and magnetic ordering; magneto-oscillatory phenomena; quantum Hall effect; superconducting phenomena and simple models. Alternate years.
Q. Hu

6.763 Applied Superconductivity
Prereq: 6.728
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Phenomenological approach to superconductivity, with emphasis on superconducting electron-

T. P. Orlando

6.772 Compound Semiconductor and Heterostructure Devices
Prereq: 6.012
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8 H-LEVEL Grad Credit

Physics, modeling, and application of compound semiconductors (primarily III-Vs and Si-Ge) in high speed electronic, optoelectronic, and photonic devices and ICs. The materials palette; theory and practice of III-V and Si-Ge heterojunctions, quantum structures, and strained layers; metal-semiconductor diodes and field effect transistors (MESFETs); heterojunction field effect transistors (HFETs) and bipolar transistors (HBTs); dielectric waveguides and photonic lattices; LEDs, laser diodes, photodetectors, and other optoelectronic devices; heterogeneous integration with Si. Alternate years.

C. G. Fonstad, Jr.

6.774 Physics of Microfabrication: Front End Processing
Prereq: 6.152J
G (Fall)
3-0-9 H-LEVEL Grad Credit

Advanced physical models and practical aspects of front-end microfabrication processes, particularly oxidation, diffusion, ion implantation, and epitaxy. Topics relevant to high performance MOS and bipolar devices, including ultra-thin gate oxides, gate etching, implant-damage enhanced diffusion, advanced metrology, stress effects on oxidation, process induced strain techniques, and strained Si/SiGe materials. CMOS process integration concepts, and impacts of processing on device characteristics. Students use modern process simulation tools.

J. L. Hoyt, L. R. Reif

6.775 CMOS Analog and Mixed-Signal Circuit Design
Prereq: 6.301
G (Spring)
3-0-9 H-LEVEL Grad Credit

A detailed exposition of the principles involved in designing and optimizing analog and mixed-signal circuits in CMOS technologies. Small-signal and large-signal models. Systemic methodology for device sizing and biasing. Basic circuit building blocks. Operational amplifier design. Large signal considerations. Principles of switched capacitor networks including switched-capacitor and continuous-time integrated filters. Basic and advanced A/D and D/A converters, delta-sigma modulators, RF and other signal processing circuits. Design projects on op amps and subsystems are a required part of the subject. 4 Engineering Design Points.

H. S. Lee, C. G. Sodini

6.776 High Speed Communication Circuits
Prereq: 6.301
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit

Principles and techniques for integrated circuit design within communication systems such as wireless and broadband data links. Circuit blocks for communication transceivers and phase-locked loops, which include broadband, narrowband, and low-noise amplifiers, mixers, voltage-controlled oscillators, power amplifiers, and high speed frequency dividers. Passive component design of on-chip inductors and capacitors. Analysis of distributed effects using transmission line modeling, S-parameters, Smith chart. Significant laboratory component. Alternate years.

J. L. Dawson, M. H. Perrott, H. S. Lee

6.777 Design and Fabrication of MEMS
(Same subject as 2.372J)
Prereq: 6.003 or 2.004, 8.02, or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit

Introduction to microsystem design. Material properties, microfabrication technologies, structural behavior, sensing methods, fluid flow, microscale transport, noise, and amplifiers feedback systems. Student teams design microsystems (sensors, actuators, and sensing/control systems) of a variety of types, (e.g., optical MEMS, bioMEMS, inertial sensors) to meet a set of performance specifications (e.g., sensitivity, signal-to-noise) using a realistic microfabrication process. Emphasis on modeling and simulation in the design process. Prior fabrication experience is desirable. 4 Engineering Design Points.

C. Livermore, M. A. Schmidt, J. Voldman

6.778 Materials and Processes for Microelectromechanical Devices and Systems
(Same subject as 2.373J, 3.48J, 10.584J, 16.288J)
Prereq: 6.152J/3.155J; permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 3.48J.

L. Anand, K. F. Jensen, M. A. Schmidt, C. V. Thompson, B. L. Wardle

6.780 Control of Manufacturing Processes
(Same subject as 2.830J, ESD.63J)
Prereq: 2.08, 2.810, 2.751J, 6.152J, or 6.041G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 2.830J.

D. E. Hardt, D. S. Boning

6.781 Submicrometer and Nanometer Technology
(Same subject as 2.391J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Surveys techniques to fabricate and analyze submicron and nanometer structures, with applications. Reviews optical and electron microscopy. Surface characterization, preparation, and measurement techniques. Resist technology. Optical projection, interferometric, X-ray, ion, and electron lithography. Aqueous, ion, and plasma etching techniques. Lift-off and electroplating. Ion implantation. Applications in microelectronics, microphotons, information storage, and nanotechnology. Undergraduates with permission of instructor.

H. I. Smith, G. Barbastathis, K. Berggren

6.789 Organic Optoelectronics
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-1-7 H-LEVEL Grad Credit

Examines optical and electronic processes in organic molecules and polymers that govern the behavior of practical organic optoelectronic devices. Electronic structure of a single organic molecule is used as a guide to the electronic behavior of organic aggregate structures. Emphasis on use of organic thin films in active organic devices including organic LEDs, solar cells, photodetectors, transistors, chemical sensors, memory cells, electrochromic devices, as well as xerography and organic nonlinear optics. Reaching the ultimate miniaturization limit of molecular electronics and related nanoscale patterning techniques of organic materials are
discussed. Laboratory sessions are conducted in a research laboratory environment with the goal of exposing students to material deposition and device testing techniques. Alternate years.
V. Bulovic

Computer Science

6.801 Machine Vision
Prereq: 6.003 or permission of instructor
U (Fall) 3-0-9

B. K. P. Horn

6.803 The Human Intelligence Enterprise
(Subject meets with 6.833)
Prereq: 6.034 or permission of instructor
U (Spring) 3-0-9

Analyzes seminal work directed at the development of a computational understanding of human intelligence, such as work on object tracking, object recognition, change representation, language evolution, and the role of symbols in learning and communication. Reviews visionary ideas of Turing, Minsky, and other influential thinkers. Examines the role of brain scanning, systems neuroscience, and cognitive psychology. Emphasis on discussion and analysis of original papers. Meets with 6.833 but assignments differ. Enrollment limited.
P. H. Winston

6.804J Computational Cognitive Science
(Same subject as 9.66J)
(Subject meets with 9.660)
Prereq: 9.07, 18.05, 6.041, or permission of instructor
U (Fall) 3-0-9

See description under subject 9.66J.
J. B. Tenenbaum

6.805 Ethics and the Law on the Electronic Frontier
(Subject meets with STS.085, STS.487)
Prereq: Permission of instructor
U (Fall) 3-0-9

Studies the growth of computer and communications technology and the new legal and ethical challenges that reflect tensions between individual rights and societal needs. Topics: computer crime; intellectual property restrictions on software; encryption, privacy, and national security; academic freedom and free speech. Students meet and question technologists, activists, law enforcement agents, journalists, and legal experts. Extensive use of the web for readings and other materials. Students engage in extensive written and oral communication exercises. 6.805 may be used as an Engineering Concentration Elective. Enrollment limited.
H. Abelson, M. Fischer

6.807 Computational Functional Genomics
(Subject meets with 6.874J, 7.90J)
Prereq: 7.012, 7.013, 7.014, or 7.015
U (Spring) 3-0-9

Study and discussion of computational approaches and algorithms for contemporary problems in functional genomics. Topics include biological complexity, genome structure and function, high-throughput experimental data, data normalization, data representation, gene clustering, statistical network models, continuous dynamic models, statistical metrics for model validation, model elaboration, experiment planning, and the computational complexity of functional genomics problems. Meets with 6.874J, but assignments differ.
D. K. Gifford, T. S. Jaakkola

6.821 Programming Languages
Prereq: Permission of instructor
G (Fall) 4-0-8 H-LEVEL Grad Credit

Principles of functional, imperative, and logic programming languages. Meta-circular interpreters, semantics (operational and denotational), type systems (polymorphism, inference, and abstract types), object oriented programming, modules, and multiprocessing. Case studies of contemporary programming languages. Programming experience and background in language implementation required.
D. K. Gifford

6.823 Computer System Architecture
Prereq: 6.004
G (Fall) 4-0-8 H-LEVEL Grad Credit

Emphasizes the relationship among technology, hardware organization, and programming systems in the evolution of computer architecture. Pipelined, out-of-order, and speculative execution. Superscalar, VLIW, vector, and multithreaded processors. Virtual memory and exception handling. I/O and memory systems. Parallel computers; message passing and shared memory systems. Memory models, synchronization, and cache coherence protocols. Embedded computers. Assumes an undergraduate knowledge of computer systems.
L. Arvind, K. Asanovic

6.824 Distributed Computer Systems
Prereq: 6.033, programming experience with C/C++
G (Fall) 3-0-9 H-LEVEL Grad Credit

Abstractions and implementation techniques for design of distributed systems; server design, network programming, naming, storage systems, security, and fault tolerance. Readings from current literature. 6 Engineering Design Points. Enrollment limited.
R. T. Morris, M. F. Kaashoek

6.825 Techniques in Artificial Intelligence
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall) 3-0-9 H-LEVEL Grad Credit

A graduate-level introduction to artificial intelligence. Topics include representation and inference in first-order logic; modern deterministic and decision-theoretic planning techniques; basic supervised learning methods; and Bayesian network inference and learning.
L. Kaelbling

6.826 Principles of Computer Systems
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

An introduction to the basic principles of computer systems with emphasis on the use of rigorous techniques as an aid to understanding and building modern computing systems. Particular attention paid to concurrent and distributed systems. Topics include: specification and verifi-
cation, concurrent algorithms, synchronization, naming, Networking, replication techniques (including distributed cache management), and principles and algorithms for achieving reliability. Alternate years.

B. W. Lampson

6.827 Multithreaded Parallelism: Languages and Compilers
Prereq: 6.001, 6.042
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Arvind

6.828 Operating System Engineering
Prereq: 6.033, 6.170
G (Fall)
3-6-3 H-LEVEL Grad Credit
Fundamental design and implementation issues in the engineering of operating systems. Lectures based on the study of a symmetric multiprocessor version of UNIX version 6 and research papers. Topics include virtual memory; file system; threads; context switches; kernels; interrupts; system calls; interprocess communication; coordination; and interaction between software and hardware. Individual laboratory assignments accumulate in the construction of a minimal operating system (for an x86-based personal computer) that implements the basic operating system abstractions and a shell. Knowledge of programming in the C language is a prerequisite. 6 Engineering Design Points.

M. F. Kaashoek

6.829 Computer Networks
Prereq: 6.033 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Topics on the engineering and analysis of network protocols and architecture, including architectural principles for designing heterogeneous networks; transport protocols; Internet routing foundations and practice; router design; congestion control and network resource management; wireless networks; network security; naming; overlay and peer-to-peer networks. Readings from original research papers and Internet RFCs. Semester-long project and paper. Enrollment may be limited. 4 Engineering Design Points.

H. Balakrishnan

6.830 Database Systems
Prereq: 6.033; 6.046) or 6.006; or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Topics related to the engineering and design of database systems, including: data models; database and schema design; schema normalization and integrity constraints; query processing; query optimization and cost estimation; transactions; recovery; concurrency control; isolation and consistency; distributed, parallel, and heterogeneous databases; adaptive databases; trigger systems; pub-sub systems; semi-structured data and XML querying. Lecture and readings from original research papers. Semester-long project and paper. Enrollment may be limited. 4 Engineering Design Points.

S. R. Madden

6.831 User Interface Design and Implementation
Prereq: 6.170 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Design, implementation, and evaluation of human-computer interfaces. Human capabilities, including the human information processing model, perception, Fitts’s Law, memory, attention, and color vision; task analysis, user-centered design, design principles; low-fidelity prototyping; heuristic evaluation, formative evaluation, controlled experiments; model-view-controller, input models, output models, constraints, layout, animation, and automatic user interface generation. Readings from current literature, short assignments, and substantial group programming project. 6 Engineering Design Points.

R. C. Miller

6.833 The Human Intelligence Enterprise
(Subject meets with 6.803)
Prereq: 6.034
G (Spring)
3-0-9 H-LEVEL Grad Credit
Intended, in part, to prepare students for MEng thesis work in the Artificial Intelligence concentration. Requires completion of supplementary exercises and a substantial term project. Enrollment limited. See description under subject 6.803.

P. H. Winston

6.834j Cognitive Robotics
(Subject meets with 16.412)
Prereq: 6.041 or 6.042; and 16.410, 16.413, 6.034, or 6.825
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 16.412.

B. C. Williams, R. Davis

6.835 Digital and Computational Photography (New)
(Subject meets with 6.865)
Prereq: 18.06 and 6.003
U (Spring)
3-0-9
Computational photography is a new field at the convergence of photography, computer vision, image processing, and computer graphics. Fundamentals and applications of hardware and software techniques, with an emphasis on software methods. Provides sufficient background to implement new solutions to photography challenges and opportunities. Topics include cameras and image formation, image processing and image representations, high-dynamic range-imaging, human visual perception and color, single view 3-D model reconstruction, morphing, data-rich photography, Super-resolution, image-based rendering. 6 Engineering Design Points.

F. P. Durand, W. T. Freeman

6.837 Computer Graphics
Prereq: 18.02, 6.170 or permission of instructor
U (Fall)
3-0-9
Introduction to computer graphics algorithms, software and hardware. Topics include ray tracing, the graphics pipeline, transformations, texture mapping, shadows, sampling, global illumination, splines, animation and color. 6 Engineering Design Points.

F. Durand, J. Popovic

6.838 Advanced Topics in Computer Graphics
Prereq: 6.837
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
In-depth study of an active research topic in computer graphics. Topics change each term. Readings from the literature, student presentations, short assignments, and a programming project.

F. P. Durand, J. Popovic
6.839 Advanced Computer Graphics
Prereq: 18.06, 6.046J, 6.837 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
A graduate level course investigates computational problems in rendering, animation, and geometric modeling. The course draws on advanced techniques from computational geometry, applied mathematics, statistics, scientific computing and other. Substantial programming experience required.
J. Popovic, F. Durand

6.840J Theory of Computation
(Same subject as 18.404J)
Prereq: 18.310 or 18.062J
G (Fall)
4-0-8 H-LEVEL Grad Credit (H except 18)
See description under subject 18.404J.
M. Sipser

6.841J Advanced Complexity Theory
(Same subject as 18.405J)
Prereq: 6.840J/18.404J
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 18.405J.
Information: M. Sudan, M. X. Goemans

6.844 Computability Theory of and with Scheme
Prereq: 6.001, 6.042J or comparable mathematical maturity
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
5-0-7 H-LEVEL Grad Credit
Theory for programmers. Introduction to programming and computability theory based on a “substitution” model of computation by Scheme programs with side effects. Computation as algebraic manipulation: provable and valid inequalities for multivariate polynomials. Scheme evaluation as algebraic manipulation and term rewriting. Paradoxes from self-application and introduction to formal programming semantics. Undecidability of the Halting Problem for Scheme. Properties of recursively enumerable sets, leading to incompleteness theorems for Scheme equivalences. Introduction to logic for program specification and verification. Hilbert’s tenth problem. Alternate years.
A. R. Meyer

6.846 Parallel Processing: Architecture and Applications
Prereq: 6.823 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
A. Agarwal

6.850 Geometric Computing
Prereq: 6.046J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
P. Indyk

6.851 Advanced Data Structures
Prereq: 6.046J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
More advanced and powerful data structures for answering several queries on the same data. Such structures are crucial in particular for designing efficient algorithms. Dictionaries; hashing; search trees. Self-organizing data structures; linear search; splay trees; dynamic optimality. Predecessor problem; van Emde Boas priority queues; y-fast trees. Word-level parallelism; fusion trees; transdichotomous RAM; RAMBO. Strings; text indexing; suffix arrays; suffix trees; compression. Static data structures; compact arrays; rank and select. Succinct data structures; tree encodings; implicit data structures. External-memory data structures; B-trees; buffer trees; cache-oblivious data structures; tree layout. Ordered-file maintenance; order queries in lists.
E. D. Demaine

6.852J Distributed Algorithms
(Same subject as 18.437J)
Prereq: 6.046J
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Design and analysis of concurrent algorithms, emphasizing those suitable for use in distributed networks. Process synchronization, allocation of computational resources, distributed consensus, distributed graph algorithms, election of a leader in a network, distributed termination, deadlock detection, concurrency control, communication, and clock synchronization. Special consideration given to issues of efficiency and fault tolerance. Formal models and proof methods for distributed computation. Alternate years.
N. A. Lynch

6.854J Advanced Algorithms
(Same subject as 18.415J)
Prereq: 6.041J or 6.042J; 6.046J
G (Fall)
5-0-7 H-LEVEL Grad Credit
First-year graduate subject in algorithms. Emphasizes fundamental algorithms and advanced methods of algorithmic design, analysis, and implementation. Surveys a variety of computational models and the algorithms for them. Data structures, network flows, linear programming, computational geometry, approximation algorithms, online algorithms, parallel algorithms, external memory, streaming algorithms.
D. R. Karger

6.855J Network Optimization
(Same subject as 15.082J, ESD.78J)
Prereq: 6.046J, 6.251J, 15.081J, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 15.082J.
A. S. Schulz
6.856j Randomized Algorithms
(Same subject as 18.416j)
Prereq: 6.854j, 6.041 or 6.042j
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Studies how randomization can be used to make algorithms simpler and more efficient via random sampling, random selection of witnesses, symmetry breaking, and Markov chains. Models of randomized computation. Data structures: hash tables, and skip lists. Graph algorithms: minimum spanning trees, shortest paths, and minimum cuts. Geometric algorithms: convex hulls, linear programming in fixed or arbitrary dimension. Approximate counting; parallel algorithms; online algorithms; derandomization techniques; and tools for probabilistic analysis of algorithms. Alternate years.

D. R. Karger

6.857 Network and Computer Security
Prereq: 6.033, 6.042j
G (Spring)
3-0-9 H-LEVEL Grad Credit

Techniques for achieving security in multi-user computer systems and distributed computer systems. Topics: physical security; discretionary and mandatory access control; biometrics; information-flow models of security; covert channels; elementary cryptography; public-key cryptography; logic of authentication; electronic cash; viruses; firewalls; electronic voting; risk assessment; secure web browsers.

R. L. Rivest

6.859j Integer Programming and Combinatorial Optimization
(Same subject as 15.083j)
Prereq: 15.081j or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

See description under subject 15.083j.

D. J. Bertsimas, A. S. Schulz

6.863j Natural Language and the Computer Representation of Knowledge
(Same subject as 9.611j)
Prereq: 6.034
G (Spring)
3-3-6 H-LEVEL Grad Credit

Relationship between computer representation of knowledge and the structure of natural language. Emphasizes development of the analytical skills necessary to judge the computational implications of grammatical formalisms, and uses concrete examples to illustrate particular computational issues. Efficient parsing algorithms for context-free grammars; augmented transition network grammars. Question answering systems. Extensive laboratory work on building natural language processing systems. 8 Engineering Design Points.

R. C. Berwick

6.864 Advanced Natural Language Processing
Prereq: 6.046j or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Graduate introduction to natural language processing, the study of human language from a computational perspective. Syntactic, semantic and discourse processing models. Emphasis on machine learning or corpus-based methods and algorithms. Use of these methods and models in applications including syntactic parsing, information extraction, statistical machine translation, dialogue systems, and summarization.

R. A. Barzilay, M. J. Collins

6.865 Advanced Computational Photography (New)
(Subject meets with 6.835)
Prereq: 6.003 and 18.06
G (Spring)
3-0-9 H-LEVEL Grad Credit

See subject description under 6.835. Requires additional advanced homework assignments and presentation of a research paper.

F. P. Durand, W. T. Freeman

6.866 Machine Vision
Prereq: 6.003 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Intensive introduction to the process of generating a symbolic description of the environment from an image. Students expected to attend the 6.801 lectures as well as occasional seminar meetings on special topics. Material presented in 6.801 is supplemented by reading from the literature. Students required to prepare a paper analyzing research in a selected area.

B. K. P. Horn

6.867 Machine Learning
Prereq: 6.034, 18.06, 6.041 or 18.05
G (Fall)
3-0-9 H-LEVEL Grad Credit

Principles, techniques, and algorithms in machine learning from the point of view of statistical inference; representation, generalization, and model selection; and methods such as linear/additive models, active learning, boosting, support vector machines, hidden Markov models, and Bayesian networks.

T. Jaakkola, L. P. Kaelbling, M. J. Collins

6.868 The Society of Mind
(Same subject as MAS.731j)
Prereq: Must have read The Society of Mind, permission of instructor
G (Spring)
2-0-10 H-LEVEL Grad Credit

Introduction to a theory that tries to explain how minds are made from collections of simpler processes. Treats such aspects of thinking as vision, language, learning, reasoning, memory, consciousness, ideals, emotions, and personality. Incorporates ideas from psychology, artificial intelligence, and computer science to resolve theoretical issues such as wholes vs. parts, structural vs. functional descriptions, declarative vs. procedural representations, symbolic vs. connectionist models, and logical vs. commonsense theories of learning. Enrollment limited.

M. Minsky

6.869 Advances in Computer Vision
Prereq: 6.801
G (Spring)
3-0-9 H-LEVEL Grad Credit

Advanced topics in mid- and high-level computer vision with a focus on the use of machine learning techniques and applications in graphics and human-computer interface. Topics may include: image representations, texture models, structure-from-motion algorithms, Bayesian techniques, projective geometry, object recognition, tracking, shape modeling, and image databases. Applications may include face recognition, multimodal interaction, interactive systems, cinematic special effects, and photorealistic rendering. Covers topics complementary to 6.801/866 and these subjects may be taken in sequence. 6.801/866 or some familiarity with low-level vision topics including image formation, stereo, and motion processing is presumed.

T. Darrell, W. T. Freeman

6.870 Advanced Topics in Computer Vision
Prereq: 6.801/6.866 or 6.869 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Can be repeated for credit

Seminar exploring advanced research topics in the field of computer vision; focus varies with lecturer. Typically structured around discussion of assigned research papers and presentations by students. Example research areas explored in this seminar include learning in vision, com-
putational imaging techniques, multimodal human-computer interaction, biomedical imaging, representation and estimation methods used in modern computer vision.

T. J. Darrell, W. T. Freeman, P. Golland, B. K. P. Horn

6.871 Knowledge-Based Applications Systems
Prereq: 6.034
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Development of programs containing a significant amount of knowledge about their application domain. Outline: brief review of relevant AI techniques; case studies from a number of application domains, chosen to illustrate principles of system development; discussion of technical issues encountered in building a system, including selection of knowledge representation and knowledge acquisition, and discussion of current and future research. Experience in building an expert system (term project). 8 Engineering Design Points.

R. Davis, H. E. Shrobe

6.872J Biomedical Computing
(Same subject as HST.950J)
Prereq: 6.034
G (Fall)
3-0-9 H-LEVEL Grad Credit

Analyzes computational needs of clinical medicine, reviews systems and approaches that have been used to support those needs, and the relationship between clinical data and gene and protein measurements. Topics: the nature of clinical data; architecture and design of healthcare information systems; privacy and security issues; medical expert systems; introduction to bioinformatics. Case studies and guest lectures describe contemporary systems and research projects. Term project using large clinical and genomic data sets integrates classroom topics. 6 Engineering Design Points.

P. Szolovits, I. Kohane, L. Ohno-Machado

6.873J Biomedical Decision Support
(Same subject as HST.951J)
Prereq: 6.034 or HST.947; programming skills or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Presents the main concepts of decision analysis, artificial intelligence, and predictive model construction and evaluation in the specific context of medical applications. Emphasizes the advantages and disadvantages of using these methods in real-world systems. Technical focus on decision analysis, knowledge-based systems (qualitative and quantitative), learning systems (including logistic regression, classification trees, neural networks), and techniques to evaluate performance of such systems. Students produce a final project using the methods learned in the subject, based on actual clinical data. Required for students in the master’s program in medical informatics, but open to other graduate students and advanced undergraduates.

L. Ohno-Machado, P. Szolovits, S. Vinterbo

6.874J Computational Functional Genomics
(Same subject as 7.90J)
Prereq: 7.012, 7.013, 7.014, or 7.015
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 7.90J.

D. K. Gifford, T. S. Jaakkola

6.875J Cryptography and Cryptanalysis
(Same subject as 18.425J)
Prereq: 6.046J
G (Spring)
3-0-9 H-LEVEL Grad Credit

A rigorous introduction to modern cryptography. Emphasis on the fundamental cryptographic primitives of public-key encryption, digital signatures, pseudo-random number generation, and basic protocols and their computational complexity requirements.

S. Goldwasser

6.876J Advanced Topics in Cryptography
(Same subject as 18.426J)
Prereq: 6.875J/18.425J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Recent results in cryptography and interactive proofs. Lectures by instructor, invited speakers, and students. Alternate years.

S. Goldwasser

6.877J Computational Evolutionary Biology
(Same subject as HST.949J)
Prereq: 6.046J, 6.047, 7.36, 6.807, or HST.508; or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit

Explores and illustrates theory underlying computational approaches to solving problems in evolutionary biology. Begins with components of evolutionary theory and inferential logic of evolution by natural selection. Emphasizes development of analytical skills needed to judge the computational and algorithmic implications and requirements of evolutionary models. Examples drawn from current research in evolutionary biology: whole-genome species comparison, phylogenetic tree construction, molecular evolution, homology and development, optimization and evolvability, heritability, disease evolution, detecting selection in human populations, and evolution of language. Extensive laboratory exercises in model-building and analyzing evolutionary data. Alternate years. 4 Engineering Design Points.

R. C. Berwick

6.878 Advanced Computational Biology: Genomes, Networks, Evolution
(Subject meets with 6.047)
Prereq: 6.001; 7.012; 18.440 or 6.041
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description for 6.047. Additionally examines recent publications in the areas covered, with research-style assignments. A more substantial final project is expected, which can lead to a thesis and publication.

M. Kellis, P. Indyk

6.881–6.899 Special Subjects in Computer Science
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Opportunity for group study of advanced subjects related to computer science not otherwise included in curriculum. Offerings initiated by members of the EECS faculty on an ad hoc basis, subject to department approval.

G. C. Verghese

Special Subjects

6.901 Inventions and Patents
Engineering School-Wide Elective Subject.
(Offered under: 3.172, 6.901, 16.652)
Prereq: 14.02
U (Fall)
3-0-6

See description under subject 3.172.

R. H. Rines
6.910–6.914 Special Studies in Electrical Engineering and Computer Science
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

6.915–6.919 Special Advanced Undergraduate Subjects in Electrical Engineering and Computer Science
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

Advanced subjects not offered in the regular curriculum. Consult department to learn of offerings for a particular term.
A. C. Smith

6.920 Practical Work Experience
Prereq: —
U (Fall, IAP, Spring, Summer)
0-1-0 [P/D/F]
Can be repeated for credit

For Course 6 students participating in off-campus work experiences in electrical engineering or computer science. Before enrolling, students must have an employment offer from a company or organization and must find an EECS supervisor. Upon completion of the work, student must submit a letter from the employer describing the work accomplished, along with a substantive final report from the student approved by the MIT supervisor. Subject to departmental approval. Consult departmental undergraduate office.
A. C. Smith

6.921 6-A Internship
Prereq: —
U (Summer)
0-12-0 [P/D/F]
Provides academic credit for the first assignment of 6-A undergraduate students at companies affiliated with the department’s 6-A internship program. Enrollment limited to students participating in the 6-A internship program.
M. Zahn

6.922 Advanced 6-A Internship
Prereq: 6.921
U (Spring, Summer)
0-12-0 [P/D/F]
Provides academic credit for the second assignment of 6-A undergraduate students at companies affiliated with the department’s 6-A internship program. Enrollment limited to students participating in the 6-A internship program.
M. Zahn

6.923 Pre-Graduate 6-A Internship
Prereq: 6.922
U (Spring, Summer)
0-12-0 [P/D/F]
Provides academic credit for the third assignment of 6-A undergraduate students at companies affiliated with the department’s 6-A internship program. Enrollment limited to students participating in the 6-A internship program.
M. Zahn

6.930 Management in Engineering
Engineering School-Wide Elective Subject.
(Offered under: 2.96, 6.930)
Units arranged
3-1-8
See description under subject 2.96.
A. V. d’Arbeloff, J.-H. Chun

6.931 Development of Inventions and Creative Ideas
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Role of the engineer as patent expert and as technical witness in court and patent interference and related proceedings. Rights and obligations of engineers in connection with educational institutions, government, and large and small businesses. Various manners of transplanting inventions into business operations, including development of New England and other US electronic industries and their different types of institutions. American systems of incentive to creativity apart from the patent laws in the atomic energy and space fields. Conducting periodic joint real-time class sessions and discussions by video-audio Internet conferencing, with other universities. For graduate students only; others see 6.901. Enrollment limited.
R. H. Rines

6.932 Advanced 6-A Internship
Prereq: 6.922
U (Spring, Summer)
0-12-0 [P/D/F]
Provides academic credit for the second assignment of 6-A undergraduate students at companies affiliated with the department’s 6-A internship program. Enrollment limited to students participating in the 6-A internship program.
M. Zahn

6.934 Engineering Risk-Benefit Analysis
Engineering School-Wide Elective Subject.
(Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.72.
G. E. Apostolakis

6.945 Large-scale Symbolic Systems (New)
Prereq: 6.001 and 6.034, or comparable programming experience
G (Spring)
3-0-9 H-LEVEL Grad Credit

Concepts and techniques for the design and implementation of large software systems that can be adapted to uses not anticipated by the designer. Applications include compilers, computer-algebra systems, deductive systems, and some artificial intelligence applications. Means for decoupling goals from strategy. Mechanisms for implementing additive data-directed invocation. Work with partially-specified entities. Manage multiple viewpoints. Topics include combinatorics, generic operations, pattern matching, pattern-directed invocation, rule systems, backtracking, dependencies, indeterminacy, memoization, constraint propagation, and incremental refinement.
G. J. Sussman, C. P. Hanson

6.946 Classical Mechanics: A Computational Approach
(Same subject as 8.351J, 12.620J)
Subject meets with 12.008
Prereq: 8.01, 18.03, 6.001, or equivalent
G (Fall)
3-3-6 H-LEVEL Grad Credit
See description under subject 12.620J.
J. Wisdom, G. J. Sussman

6.951 Graduate 6-A Internship
Prereq: 6.921, 6.922, or 6.923
G (Fall, Spring, Summer)
0-12-0 [P/D/F]
Provides academic credit for a graduate assignment of graduate 6-A students at companies affiliated with the department’s 6-A internship program. Enrollment limited to graduate students participating in the 6-A internship program.
M. Zahn

6.952 Graduate 6-A Internship
Prereq: 6.951
G (Fall, Spring, Summer)
0-12-0 [P/D/F]
Provides academic credit for graduate students who require an additional term at the company to complete the graduate assignment of the department’s 6-A internship program. This academic credit is for registration purposes only and cannot be used toward fulfilling the requirements of any degree program. Enrollment limited to graduate students participating in the 6-A internship program.
M. Zahn
6.961 Introduction to Research in Electrical Engineering and Computer Science
Prereq: —
G (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Opportunity to become involved in graduate research, under guidance of a staff member, on a problem of mutual interest to student and supervisor. Recommended for all full-time graduate students entering the Department of Electrical Engineering and Computer Science. Individual programs subject to approval of professor in charge. Enrollment restricted to regular graduate students in Electrical Engineering and Computer Science. Normal registration is for 12 units.
T. P. Orlando

6.962–6.969 Special Studies in Electrical Engineering and Computer Science
Prereq: —
G (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Opportunity for study of graduate-level topics related to electrical engineering and computer science but not included elsewhere in the curriculum. Registration under this subject normally used for situations involving individual study (under supervision of a faculty member) concerning topics of mutual interest to student and supervisor, but may, when appropriate, be used for small study groups. Normal registration is for 12 units. Registration subject to approval of professor in charge.
A. C. Smith

6.971–6.979 Special Subjects in Electrical Engineering and Computer Science
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for group study of advanced subjects related to Electrical Engineering and Computer Science not otherwise included in curriculum. Offerings initiated by members of EECS faculty on an ad hoc basis, subject to departmental approval.
G. C. Verghese

6.980 Teaching Electrical Engineering and Computer Science
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
For qualified students interested in gaining teaching experience. Classroom, tutorial, or laboratory teaching under the supervision of a faculty member. Enrollment limited by availability of suitable teaching assignments.
G. C. Verghese

6.981 Teaching Electrical Engineering and Computer Science
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
For Teaching Assistants in Electrical Engineering and Computer Science, in cases where teaching assignment is approved for academic credit by the department.
G. C. Verghese

6.985–6.989 Special Subjects in Electrical Engineering
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for group study of advanced subjects related to electrical engineering outside of the curriculum. Offerings initiated by members of the EECS faculty on an ad hoc basis, subject to department approval.
G. C. Verghese

6.991 Research in Electrical Engineering and Computer Science
Prereq: —
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
For Research Assistants in Electrical Engineering and Computer Science, in cases where the assigned research is approved for academic credit by the department. Hours arranged with research supervisor.
A. C. Smith

6.CME Study at Cambridge University
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Provides credit for students studying at Cambridge University under the Cambridge-MIT Undergraduate Student Exchange Program. Credit may be used to satisfy specific SB degree requirements by arrangement with the department.
D. S. Boning, T. Akinwande

6.EPW UPOP IAP Workshop
Engineering School-Wide Elective Subject.
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW, 10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]
See description under subject 2.EPW.
D. K. P. Yue

6.ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of an SM, EE, ECS, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member.
A. C. Smith

6.ThM Master of Engineering Program Thesis
Prereq: 6.UAT
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of an MEng thesis; to be arranged by the student and an appropriate MIT faculty member. Restricted to MEng students who have been admitted to the MEng program.
A. C. Smith
6.U.R Undergraduate Research in Electrical Engineering and Computer Science

Prereq: —
U (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Extended participation in the work of a faculty member or research group, including independent study of the literature, direct involvement in the group's research, and project work under an individual faculty member. Research is arranged by mutual agreement between the student and a member of the faculty of the Department of Electrical Engineering and Computer Science, and may continue over several terms. Forms and instructions for the initial letter of intent and final summary report are available in the department undergraduate office.

A. C. Smith
UNDERGRADUATE SUBJECTS

7.02 Introduction to Experimental Biology and Communication
(Subject meets with 10.702)
Prereq: —
7.02—U (Fall)
Prereq: 7.012, 7.013, 7.014, or 7.015
7.03—U (Spring)
4-8-6 Institute LAB
Application of experimental techniques in microbiology, biochemistry, and cell and developmental biology. Emphasizes integrating factual knowledge with understanding the design of experiments and data analysis to prepare students for research projects. Development of skills critical for writing about scientific findings in modern biology. Instruction and practice in written communication provided. Twelve units may be applied to the General Institute Laboratory Requirement. Enrollment limited.
D. Kim, T. Schwartz

7.03 Genetics
Prereq: 7.012, 7.013, 7.014, or 7.015
4-0-8 REST
The principles of genetics with application to the study of biological function at the level of molecules, cells, and multicellular organisms, including humans. Structure and function of genes, chromosomes, and genomes. Biological variation resulting from recombination, mutation, and selection. Population genetics. Use of genetic methods to analyze protein function, gene regulation, and inherited disease.
C. Kaiser, G. Fink, P. Reddien

7.05 General Biochemistry
Prereq: 5.12; 7.012, 7.013, 7.014, or 7.015; or permission of instructor
U (Spring)
5-0-7 REST
Credit cannot also be received for 5.07
Contributions of biochemistry toward an understanding of the structure and functioning of organisms, tissues, and cells. Chemistry and functions of constituents of cells and tissues and the chemical and physical-chemical basis for the structures of nucleic acids, proteins, and carbohydrates. General metabolism of carbohydrates, fats, and nitrogen-containing materials such as amino acids, proteins, and related compounds.
M. Yaffe, D. Bartel, G. M. Brown

7.06 Cell Biology
Prereq: 7.03, 7.05
U (Fall, Spring)
4-0-8
Biology of cells of higher organisms: structure, function, and biosynthesis of cellular membranes and organelles; cell growth and oncogenic transformation; transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure and RNA synthesis.
Fall: A. Amon, H. Lodish
Spring: T. Orr-Weaver, H. Ploegh

7.08 Biological Chemistry II
(Subject meets with 5.08j)
Prereq: 5.12; 5.07 or 7.05
U (Spring)
4-0-8
See description under subject 5.08j.
A. Y. Ting, J. Stubbe

7.11 Biology Teaching
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
For qualified undergraduate students interested in gaining some experience in teaching. Laboratory, tutorial, or classroom teaching under the supervision of a faculty member. Students selected by interview.
Consult Biology Education Office

7.13 Experimental Microbial Genetics
Prereq: 7.02, 7.03, 7.05
U (Fall)
4-16-10
Molecular genetics used to examine how bacteria can be used in novel and relevant processes, for example, to synthesize precursors to the drug Crixivan, a potent inhibitor of HIV replication, to synthesize metabolites as food supplements, or to synthesize biodegradable polymers. Students engage in independent research projects to address questions relating to these processes. Techniques used include plasmid manipulation, genetic complementation, mutagenesis, PCR, DNA sequencing,
enzyme assays, and gene expression studies. Instruction and practice in written and oral communication are also emphasized.

A. J. Sinskey

7.16 Experimental Molecular Biology: Biotechnology II
Prereq: 7.02, 7.03, 7.05
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-16-10

RNA interference (RNAi) as a core technique to study gene regulatory pathways in eukaryotic cells. Projects focus on dissecting the pathways controlling apoptosis (programmed cell death) and/or other regulatory pathways, such as those controlling the cell cycle or alternative splicing, in Drosophila S2 cells. Some projects involve the use of DNA-damaging agents or other cytotoxic chemicals or drugs to help understand the pathways that control a cell’s decision to undergo apoptosis. Instruction and practice in written and oral communication provided.

C. Burgue, D. Sabatini

7.17 Experimental Molecular Biology: Biotechnology III
Prereq: 7.02, 7.03, 7.05
U (Spring)
4-16-10

Cell and molecular biology lab that uses recombinant DNA methods and optical microscopy to study cellular mechanisms in eukaryotic cells. Projects focus on mechanisms of intracellular protein translocation and cytoskeletal rearrangement. Students explore the recombinant fluorescent proteins using imaging techniques and describe the effects of the expressed protein on cell motility, the cell cycle, or the organization and function of cytoplasmic organelles and the cytoskeleton. Projects involve many techniques, such as DNA sequence analysis, RNAi, RT-PCR, and Western blotting. Instruction and practice in written and oral communication provided.

F. Gertler, M. L. Pardue

7.18 Topics in Experimental Biology
(Subject meets with 7.19)
Prereq: 7.02, 7.03, 7.05
U (Fall, Spring)
4-16-10

Credit cannot also be received for 7.19

Independent experimental study under the direction of a member of the Biology Department faculty. Allows students with a strong interest in independent research to fulfill the project laboratory requirement for the Biology Department Program in the context of a research laboratory at MIT. The research should be a continuation of a previous project. Written and oral presentation of the research results is required. Journal club discussions are used to help students evaluate and write scientific papers. Instruction and practice in written and oral communication is provided. Permission of the faculty research supervisor and the Biology Education Office must be obtained in advance.

Fall: P. Matsudaira, M. L. Pardue
Spring: J. Chen, A. J. Sinskey

7.19 Communication in Experimental Biology
(Subject meets with 7.18)
Prereq: 7.02, 7.03, 7.05
U (Fall, Spring)
4-4-4

Credit cannot also be received for 7.18

Students carry out independent literature research. Meets with the seminar and writing tutorial portions of 7.18. Journal club discussions are used to help students evaluate and write scientific papers. Instruction and practice in written and oral communication is provided. Permission of the instructor and the Biology Education Office must be obtained in advance.

Fall: P. Matsudaira, M. L. Pardue
Spring: J. Chen, A. J. Sinskey

7.20 Human Physiology
(Same subject as HST.540J)
Prereq: 7.05
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
5-0-7

Comprehensive subject in human physiology, emphasizing the molecular basis and applied aspects of organ function and regulation in health and disease. Includes a review of cell structure and function, as well as the mechanisms by which the endocrine and nervous systems integrate cellular metabolism. Special emphasis on examining the cardiovascular, pulmonary, gastrointestinal, and renal systems.

M. Krieger, D. Sabatini

7.21 Microbial Physiology
(Subject meets with 7.62)
Prereq: 7.05, 7.03
U (Fall)
4-0-8

Biochemical properties of bacteria and other microorganisms that enable them to grow under a variety of conditions. Interaction between bacteria and bacteriophages. Genetic and metabolic regulation of enzyme action and enzyme formation. Structure and function of components of the bacterial cell envelope. Protein secretion with a special emphasis on its various roles in pathogenesis. Additional topics include symbiosis, quorum sensing, global responses to DNA damage, and biofilms. Students taking graduate version are expected to explore the subject in greater depth.

G. C. Walker, B. Magasanik

7.22 Development and Evolution
Prereq: 7.03, 7.06
U (Fall)
5-0-7

Covers animal development and evolution. Topics include origins of multicellularity, the germline, formation of early body plans, cell type determination, organogenesis, morphogenesis, stem cells, cloning, evolution of developmental diversity and processes, developmental genetics, and issues in human development. Experimental approaches to problems of development and evolution, including the study of vertebrate (mouse, chick, frog, fish) and invertebrate (fly, worm) models, will be covered.

M. Constantine-Paton, P. Reddien

7.23 General Immunology
(Subject meets with 7.63)
Prereq: 7.05, 7.03, 7.06, or permission of instructor
U (Spring)
5-0-7

A comprehensive survey of molecular, genetic, and cellular aspects of the immune system. Topics include innate and adaptive immunity; cells and organs of the immune system; immunoglobulin, T cell receptor, and major histocompatibility complex (MHC) genes and structure; development and functions of B and T lymphocytes; immune responses to infections and tumors; hypersensitivity, autoimmunity, and immunodeficiencies. Particular attention is paid to the development and function of the immune system as a whole as studied by modern methods and techniques.

J. Chen, H. Ploegh, L. Steiner

7.24 The Protein Folding Problem
(Subject meets with 5.48J, 7.88J, 10.543J)
Prereq: 7.05 or 5.07
U (Fall)
4-2-6

See description under subject 7.88.

J. A. King

7.25 Biological Regulatory Mechanisms
Prereq: 7.02, 7.03, 7.05
U (Spring)
4-0-8

Cells utilize a variety of mechanisms to regulate gene expression, growth, development, and
behavior in response to both external and internal conditions. Examines basic principles of biological regulation, focusing on several well-studied examples, usually drawn from microbial species. Reading includes primary literature and review articles with emphasis on how we know what we know, and how to think experimentally. Enrollment limited to 40.

B. Magasanik, U. RajBhandary

7.27 Principles of Human Disease
Prereq: 7.03, 7.05, 7.06
U (Spring)
4-0-8
Covers current understanding of and modern approaches to human disease, emphasizing the molecular and cellular basis of both genetic disease and cancer. Topics include the genetics of simple and complex traits; karyotypic analysis and positional cloning; genetic diagnosis; the interaction between genetics and environment; animal models of human disease; cancer; and conventional and gene therapy treatment strategies.

D. Houseman, L. Guarente

7.28 Molecular Biology
(Subject meets with 7.58)
Prereq: 7.03; 7.05
U (Spring)
5-0-7
Detailed analysis of the biochemical mechanisms that control the maintenance, expression, and evolution of prokaryotic and eukaryotic genomes. Topics covered in lecture and readings of relevant literature include: gene regulation, DNA replication, genetic recombination, and mRNA translation. Logic of experimental design and data analysis are emphasized. Presentations include both lectures and group discussions of representative papers from the literature. Students taking the graduate version are expected to explore the subject in greater depth.

T. Baker, S. Bell

7.29J Cellular Neurobiology
(Same subject as 9.09J)
Prereq: 7.05
U (Spring)
4-0-8
Introduction to the structure and function of the nervous system. Emphasizes the cellular properties of neurons and other excitable cells. Includes the structure and biophysical properties of excitable cells, synaptic transmission, neurochemistry, neurodevelopment, integration of information in simple systems, and detection and information coding during sensory transduction.

W. G. Quinn, J. T. Littleton

7.30J Ecology I: The Earth System
(Same subject as 1.018J)
Prereq: —
U (Fall)
3-1-8 REST
See description under subject 1.018J.

S. W. Chisholm, E. Delong

7.31 Current Topics in Mammalian Biology: Medical Implications
Prereq: 7.05, 7.06, or permission of instructor
U (Fall)
4-0-8
Covers recent advances in mammalian cell and developmental biology with particular emphasis on approaches that utilize mouse genetics. Combines formal lectures on selected topics with readings of original papers which are discussed in class. Major emphasis on the implications of mechanisms of human genetic diseases. Topics include early mammalian development; genomic imprinting; X inactivation; embryonic stem cells; mammalian cloning by nuclear transplantation; cell migration; nervous system development; and central nervous system degenerative diseases such as Alzheimer’s and Huntington’s disease. Enrollment limited to 20.

F. Gertler, R. Jaenisch

7.340–7.349 Advanced Undergraduate Seminars
Prereq: 7.03, 7.05, 7.06, or 7.28
U (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Seminars covering topics of current interest in biology with a focus on how to understand experimental methods and design and how to critically read the primary research literature. Small class size facilitates discussions and interactions with an active research scientist. Students visit research laboratories to see firsthand how biological research is done. Contact Biology Education Office for topics.

H. R. Horvitz, Staff

7.35 Topics in Metabolic Biochemistry
(Same subject as 7.77J, 7.75J)
Prereq: 7.05 or 5.07
U (Fall)
4-0-8
Topics include major metabolic pathways for the biosynthesis of certain cellular constituents and oxidative metabolism. Emphasizes enzymology and methods used to understand metabolism and enzymatic processes.

G. M. Brown

7.36 Foundations of Computational and Systems Biology
(Subject meets with 7.91J, 20.390, 20.490J)
Prereq: 7.05 or 5.07; or 7.01x and 1.00 or 1.001 or 6.00 or 6.001; or permission of instructor
U (Spring)
3-0-9
Introduction to computational biology emphasizing the fundamentals of nucleic acid and protein sequence and structural analysis, as well as the analysis of complex biological systems. Principles and methods used for sequence alignment, motif finding, expression array analysis, structural modeling, structure prediction and network modeling. Techniques include dynamic programming, Markov models, clustering techniques, dead-end elimination and energy minimization approaches. Exposure to currently emerging research areas. Designed for advanced undergraduates and graduate students with strong backgrounds in either molecular biology or computer science. Some foundational material covering basic programming skills, probability and statistics is provided for students with non-quantitative backgrounds. Enrollment limited to 90.

S. W. Chisholm, E. Delong

7.37J Molecular and Engineering Aspects of Biotechnology
(Same subject as 10.441J, 20.361J)
Prereq: 20.110/2.772, 2.005, 3.012, or 5.60; 7.06; or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8
Biological and bioengineering principles underlying the development and use of recombinant proteins as therapeutic drugs; fundamentals of therapeutic protein action, including cell-cell and cell-matrix interactions and intracellular signaling pathways; classes of protein therapeutics; post-translational processing and secretion of proteins; gene cloning and expression in mammalian cells; physiology of cell growth and in vitro cultivation; site-specific mutation of proteins; protein pharmacology and delivery.

H. Lodish, L. G. Griffith
7.39 Selected Topics in Biology for Undergraduates
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit
Program of study or research to be arranged with a Department faculty member. Written report required. Consult Biology Education Office. 
Staff

7.391 Special Topics in Biology for Undergraduates
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

7.392 Special Topics in Biology for Undergraduates
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Topics of current or special interest. 
Staff

7.40 Biotechnology: Engineering of Macromolecules
Prereq: 7.05
U (Spring)
3-0-6
Fundamentals of genetics and biochemical principles for the synthesis, design, engineering, and application of biopolymers such as polymers and polysaccharides. Principles underlying structure-function properties of biopolymers. Topics include conformation, image, and nanostructure analysis; behavior of polymers in solution; structure, topography, and functional performance of biopolymers; and biopolymer complexes and assemblies. 
C. K. Rha, A. J. Sinskey

7.UR Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

7.URG Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Undergraduate research opportunities in the Department of Biology. For further information, consult departmental coordinator, Gene Brown. Permission of department required. 
Staff

GRADUATE SUBJECTS

7.410 Applied Statistics
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Applied statistics covers probability and distributions (normal binomial, poisson, exponential, lognormal, and uniform), estimation and hypothesis testing, parametric and nonparametric one-sample and two-sample tests of means, analysis of variance for crossed and nested designs, linear and multiple regression with residual analysis, correlation and discrete data analysis using chi-squared tests. Discussion of experimental and sampling designs is included. Examples use data from biological studies. 
V. Starczak (WHOI)

7.411–7.419 Seminars in Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Selected topics in biological oceanography. 
Information: J. Waterbury (WHOI)

7.421 Special Problems in Biological Oceanography
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Advanced problems in biological oceanography with assigned reading and consultation. 
Information: J. Waterbury (WHOI)

7.430 Topics in Quantitative Marine Science
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on quantitative marine ecology. Topics vary from year to year. 
A. Solow, M. Neubert (WHOI)

7.431 Topics in Marine Ecology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on ecological principles and processes in marine populations, communities, and ecosystems. Topics vary from year to year. 
H. Caswell, R. Harbison (WHOI)

7.432 Topics in Marine Physiology and Biochemistry
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on physiological and biochemical processes in marine organisms. Topics vary from year to year. 
M. Hahn, J. McDowell, J. Stegeman (WHOI)

7.433 Topics in Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on biological oceanography. Topics vary from year to year. 
R. Gast (WHOI)

7.434 Topics in Zooplankton Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on the biology of marine zooplankton. Topics vary from year to year. 
L. Madin, R. Harbison (WHOI)

7.435 Topics in Benthic Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussions on the biology of marine benthos. Topics vary from year to year. 
L. Mullineaux, R. Scheltema, T. Shank (WHOI)

7.436 Topics in Phytoplankton Biology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Lectures and discussion on the biology of marine phytoplankton. Topics vary from year to year. 
R. Olson, H. Sosik, D. Anderson, S. Dyhrman (WHOI)
7.437 Topics in Molecular Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit

Lectures and discussion on molecular biological oceanography. Topics vary from year to year.
M. Hahn, T. Shank, R. Gast, D. Anderson, S. Sievert (WHOI)

7.438 Topics in the Behavior of Marine Animals
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit

Lectures and discussion on the behavioral biology of marine animals. Topics vary from year to year.
P. Tyack, M. Moore (WHOI)

7.439 Topics in Marine Microbiology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit

Lectures and discussion on the biology of marine prokaryotes. Topics vary from year to year.
J. Waterbury, S. Sievert, E. Webb (WHOI)

7.440 An Introduction to Mathematical Ecology
Prereq: 18.01, 1.018 J, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit

Covers the basic models of population growth, demography, population interaction (competition, predation, mutualism), food webs, harvesting, and infectious disease, and the mathematical tools required for their analysis. Because these tools are also basic to the analysis of models in biochemistry, physiology, and behavior, subject also broadly relevant to students whose interests are not limited to ecological problems.
M. Neubert, H. Caswell (WHOI)

7.47 Biological Oceanography
Prereq: Advanced training in biology
G (Spring)
3-0-9 H-LEVEL Grad Credit

Intensive overview of biological oceanography. Major paradigms discussed, and dependence of biological processes in the ocean on physical and chemical aspects of the environment examined. Surveys the diversity of marine habitats, major groups of taxa inhabiting those habitats, and the general biology of the various taxa: the production and consumption of organic material in the ocean, as well as factors controlling those processes. Species diversity, structure of marine food webs, and the flow of energy within different marine habitats are detailed and contrasted.
L. Mullineaux, H. SOSik, J. Pineda, S. Dyhrman, E. Webb (WHOI)

7.491 Research in Biological Oceanography
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Directed research in biological oceanography not leading to graduate thesis and generally done before the qualifying examination. Possible areas include population dynamics, physiology, and cytology of marine microorganisms; physiology, nutrition, and productivity of phytoplankton; influence of organisms on the composition of seawater; systematics, physiology, and ecology of pelagic larvae, zooplankton, benthos, and mesopelagic fishes; physiology and migration of large fishes; diving physiology; and use of sound by marine mammals.
Woods Hole Staff

7.50 Method and Logic in Molecular Biology
Prereq: 7.51 and 7.52, or permission of instructor
G (Fall)
4-0-8 [P/D/F] H-LEVEL Grad Credit

Logic and experimental design: an in-depth discussion and assessment of biochemical, physical, genetic, and cell biological methods employed in testing hypotheses. Limited to Course 7 graduate students.

7.51 Principles of Biochemical Analysis
Prereq: Permission of instructor
G (Fall)
6-0-6 H-LEVEL Grad Credit

Fundamental principles of biochemistry. Analysis of the structure and mechanism of catalytic and regulatory macromolecules.
T. Baker, R. T. Sauer, F. Solomon

7.52 Genetics for Graduate Students
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit

Principles and approaches of genetic analysis, including Mendelian inheritance and prokaryotic genetics, developmental genetics, neurogenetics, human genetics, genomics, and epigenetics.
Recitations and problem sets supplement lectures.
H. R. Horvitz, D. Housman, A. Amon

7.547 Principles and Practice of Drug Development
(Same subject as 10.547 J, 15.136 J, HST.920 J)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

See description under subject 15.136 J.
T. J. Allen, C. L. Cooney, S. N. Finkelstein, R. H. Rubin, A. J. Sinsky

7.548 Perspectives in Biological Engineering
(Same subject as 20.400 J)
Prereq: Permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit

See description under subject 20.400 J.
F. White, E. Fraenkel

7.549 Case Studies and Strategies in Drug Discovery and Development
(Same subject as 15.137 J, 20.486 J, HST.916 J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 20.486 J.

7.56 Foundations of Cell Biology
Prereq: Permission of instructor
G (Spring)
5-0-7 H-LEVEL Grad Credit

Designed for graduate students interested in understanding biological processes at the cellular level. Intended to be useful to biologists working in a wide range of areas and to provide the foundation to approach the current literature. The goals are to discuss fundamental topics in cell and molecular biology; demonstrate how the major questions have been approached, technically and intellectually; analyze how one interprets the data produced by those approaches; and identify the questions that remain. Topics include macromolecular synthesis, assembly of cellular complexes and structures, control of cell division, and cell signaling. Familiarity with the basics of biochemistry and genetics is assumed.
S. Bell, F. Solomon
7.57 Quantitative Biology for Graduate Students (New)
Prereq: Permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Introduces the fundamental concepts and tools of quantitative approaches to molecular and cellular biology. Covers a wide range of mathematical, computational, and statistical methods, although no previous expertise in these areas is required. Focuses on understanding quantitative approaches through the analysis of particular problems and examples drawn from classical genetics, molecular biology, cell biology, genomics, and systems biology.
M. Laub, A. Regev

7.58 Molecular Biology
(Subject meets with 7.28)
Prereq: 7.03; 7.05
G (Spring)
5-0-7 H-LEVEL Grad Credit
See description under subject 7.28
T. Baker, S. Bell

7.59] Teaching College-Level Science
(Same subject as 5.95), 8.395), 18.094)
Prereq: —
G (Spring)
2-0-2 [P/D/F]
See description under subject 5.95].
L. Breslow

7.60 Cell Biology: Structure and Functions of the Nucleus
Prereq: 7.06
G (Spring)
4-0-8 H-LEVEL Grad Credit
Eukaryotic genome structure, function, and expression, processing of RNA, and regulation of the cell cycle. Emphasis on the techniques and logic used to address important problems in nuclear cell biology. Lectures on broad topic areas in nuclear cell biology and discussions on representative recent papers.
P. Sharp, R. Young

7.61 Eukaryotic Cell Biology: Principles and Practice
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Emphasizes methods and logic used to analyze eukaryotic cells in diverse systems (e.g., yeast, fly, worm, mouse, human; development, neurons). Subject combines lectures and in-depth roundtable discussions of literature readings with active participation of faculty experts. Focuses on membranes, organelles, the cell surface, cytoskeleton and extracellular matrix. Topics include membrane protein structure, cell surface receptors and transporters; signal transduction pathways; membrane trafficking/secretion; adhesion and its effects on organization, migration and polarity of cells; regulation of the cell cycle; integration of cells into tissues and organs. Ranges from basic studies to applications to human disease, while emphasizing critical analysis of experimental approaches. Limited enrollment.
R. O. Hynes, Staff

7.62 Microbial Physiology (New)
(Subject meets with 7.21)
Prereq: 7.05, 7.03
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 7.21.
G. C. Walker, B. Magasanik

7.63 Immunology
(Subject meets with 7.23)
Prereq: Permission of instructor
G (Spring)
5-0-7 H-LEVEL Grad Credit
See description under subject 7.23.
J. Chen, H. Ploegh, L. Steiner

7.67] Genetic Neurobiology
(Same subject as 9.322)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject 9.322).
W. G. Quinn, J. T. Littleton

7.68] Cellular and Molecular Neurobiology
(Same subject as 9.133)
Prereq: 9.011 or permission of instructor
G (Spring)
6-0-12 H-LEVEL Grad Credit
See description under subject 9.013).
M. Sheng, M. Constantine-Paton, W. Quinn

7.69] Developmental Neurobiology
(Subject meets with 9.181)
Prereq: 9.011 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit
See description under subject 9.181).
E. Nedivi

7.70 Regulation of Gene Expression
Prereq: Permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Cells utilize a variety of mechanisms to regulate gene expression, growth, development, and behavior in response to both external and internal conditions. Examines basic principles of biological regulation, focusing on several well-studied examples, usually drawn from microbial species. Readings include primary literature and review articles with emphasis on how we know what we know, and how to think experimentally. Enrollment limited to 40.
G. Fink, Staff

7.71 Biophysical Chemistry Techniques
(Subject meets with 5.78)
Prereq: 5.13, 5.60; 5.07 or 7.05
G (Spring)
5-0-7
For students who want to understand the benefits and caveats of biophysical techniques used to ascertain the structure of macromolecules, especially on the 3-D level. The first half of the course focuses on X-ray crystallography, the single most important technique used in determining the 3-D structure of macromolecules. Discussion of crystallographic theory is complemented with exercises such as crystallization, data processing, and model building. In the second half of the course, biophysical techniques are covered that supplement the 3-D characterization of biological macromolecules. Topics include CD spectroscopy, isothermal calorimetry, analytical ultracentrifugation, dynamic light and small-angle X-ray scattering. Theoretical principles behind the techniques are covered, and students are given practical exercise using instrumentation available at MIT.
C. Drennan, T. Schwartz

7.72 Development and Evolution
Prereq: Permission of instructor
G (Fall)
5-0-7 [P/D/F]
Lectures and literature discussion cover animal development and evolution. Focus on molecular mechanisms, experimental approaches, and relevant disorders. Comparison of vertebrate (mouse, chick, frog, fish) and invertebrate (fly, worm) models. Topics include the early body plan, cell type determination and diversity, organogenesis, morphogenesis, stem cells, cloning, and issues in human development.
H. Sive, T. Orr-Weaver
**7.75 Topics in Metabolic Biochemistry**  
(Same subject as 5.77J)  
(Subject meets with 7.35)  
Prereq: 7.05 or 5.07  
G (Fall)  
4-0-8 H-LEVEL Grad Credit  
See description under subject 7.35.  
*G. M. Brown*

**7.76 Topics in Protein Biochemistry**  
Prereq: Permission of instructor  
G (Spring)  
2-0-7  
In-depth analysis and discussion of classic and current literature with emphasis on the relationship between protein structure and function. Topics include binding specificity; cooperativity and allostery; protein folding and macromolecular assembly; sequence homology and prediction of structure; and protein engineering and design. Undergraduates should have taken 7.71 or 5.64.  
*A. Keating, R. T. Sauer*

**7.77 Nucleic Acids, Structure, Function, Evolution and Their Interactions with Proteins**  
Prereq: 7.05 or 7.51  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Lectures, analysis, and discussion of current literature, student presentations. Biochemical, biophysical, and genetic approaches to understanding nucleic acids. General properties, functions, and structural motifs of DNA and RNA. DNAs and RNAs as catalysts. Interaction of nucleic acids with proteins such as repressors, restriction and modification enzymes, aminoacyl-tRNA synthetases and other proteins of the translational machinery, RNA protein recognition. Selection and engineering approaches for generating nucleic acid molecules with novel catalytic and binding properties.  
*D. Bartel, U. RajBhandary*

**7.80 Biological Chemistry II (New)**  
(Subject meets with 5.08J, 7.08J)  
Prereq: 5.12; 5.07 or 7.05  
G (Spring)  
4-0-8 H-LEVEL Grad Credit  
See description under subject 5.08J. Students taking the graduate version are expected to explore the subject in greater depth.  
*A. Y. Ting, J. Stubbe*

**7.81 Systems Biology**  
(Same subject as 8.591J, 9.531J)  
Prereq: —  
G (Fall)  
3-0-9  
See description under subject 8.591J.  
*A. Van Oudenaarden*

**7.82 Topics of Mammalian Development and Genetics**  
Prereq: —  
G (Spring)  
3-0-9 [P/D/F]  
Seminar covering embryologic, molecular, and genetic approaches to development in mice and humans. Topics include preimplantation development; gastrulation; embryonic stem cells, gene targeting and nuclear cloning; genomic imprinting; X-inactivation; sex determination; germ cells; association and linkage analysis.  
*R. Jaenisch, D. Page*

**7.88 The Protein Folding Problem**  
(Same subject as 5.48J, 10.543J)  
(Subject meets with 7.24)  
Prereq: 5.07 or 7.05  
G (Fall)  
4-2-6 H-LEVEL Grad Credit  
Mechanisms by which the amino acid sequence of polypeptide chains determines their three-dimensional conformation. Topics include: sequence determinants of secondary structure; folding of newly synthesized polypeptide chains within cells; unfolding and refolding of proteins in vitro; folding intermediates aggregation and competing off-pathway reactions; role of chaperonins, isomerases, and other helper proteins; protein recovery problems in the biotechnology industry; diseases associated with protein folding defects.  
*J. A. King*

**7.89 Topics in Computational and Systems Biology (New)**  
(Same subject as CSB.100J)  
Prereq: Permission of instructor  
G (Fall)  
2-0-10 H-LEVEL Grad Credit  
See description under subject CSB.100J.  
*C. Burge*

**7.90 Computational Functional Genomics**  
(Same subject as 6.874J)  
(Subject meets with 6.807)  
Prereq: 7.012, 7.013, 7.014, or 7.015  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Focuses on casting contemporary problems in systems biology and functional genomics in computational terms and providing appropriate tools and methods to solve them. Topics include genome structure and function, transcriptional regulation, and stem cell biology in particular; measurement technologies such as microarrays (expression, protein-DNA interactions, chromatin structure); statistical data analysis, predictive and causal inference, and experiment design. Emphasis on coupling problem structures (biological questions) with appropriate computational approaches.  
*D. Gifford, T. S. Jaakkola*

**7.91j Foundations of Computational and Systems Biology**  
(Same subject as 20.490J)  
(Subject meets with 7.36, 20.390)  
Prereq: 7.05 or 5.07; or 7.01x and 1.00 or 1.001 or 6.00 or 6.001; or permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 7.36.  
*C. Burge, A. Keating*

**7.92 Neurology, Neuropsychology, and Neurobiology of Aging**  
(Same subject as 9.110J)  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 9.110J.  
*S. Corkin*

**7.93 Selected Topics in Biology for Graduate Students**  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Classwork in various fields of biology not covered by the regular subjects of instruction.  
*Staff*
7.931 Special Topics in Biology for Graduate Students
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
7.932 Special Topics in Biology for Graduate Students
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Topics of current or special interest.
Staff

7.941 Research Problems
Prereq: —
G (Fall)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
7.942 Research Problems
Prereq: —
G (Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Directed research in a field of biological science, but not contributory to graduate thesis.
Consult Biology Education Office

7.95 Cancer Biology
Prereq: 7.03, 7.06
G (Spring)
3-0-9 [P/D/F] H-LEVEL Grad Credit
Intensive analysis of historical and current developments in cancer biology. Topics include principles of transformation, viral and cellular oncogenes, tumor suppressor genes, tumor-cell growth, apoptosis, principles of cancer biology, and cancer genetics. Detailed analyses of the current research literature including important research reports published in recent years. Limited enrollment.
J. Lees, R. Weinberg

7.98J Neural Plasticity in Learning and Memory
(Same subject as 9.301J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 9.301J.
S. Tonegawa, M. Bear, W. Quinn, M. Wilson

7.78G Graduate Biology Thesis
Prereq: —
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of a PhD thesis; to be arranged by the student and an appropriate MIT faculty member.
Staff
UNDERGRADUATE SUBJECTS

8.01 Physics I
Prereq: —
U (Fall)
3-2-7 PHYSICS I
Credit cannot also be received for 8.011, 8.012, 8.01L, 8.01T

Introduces classical mechanics. Space and time: straight-line kinematics; motion in a plane; forces and static equilibrium; particle dynamics, with force and conservation of momentum; relative inertial frames and non-inertial force; work, potential energy and conservation of energy; kinetic theory and the ideal gas; rigid bodies and rotational dynamics; vibrational motion; conservation of angular momentum; central force motions; fluid mechanics. Subject taught using the TEAL (Technology-Enabled Active Learning) format which features small group interaction via table-top experiments utilizing laptops for data acquisition and problem solving workshops.

J. D. Litster

8.01L Physics I
Prereq: —
U (Spring)
3-2-7 PHYSICS I
Credit cannot also be received for 8.01, 8.011, 8.012, 8.01T

Introduces classical mechanics. Space and time: straight-line kinematics; motion in a plane; forces and static equilibrium; particle dynamics; universal gravitation; collisions and conservation laws; work and potential energy; vibrational motion; conservative forces; inertial forces and non-inertial frames; central force motions; rigid bodies and rotational dynamics.

Staff

8.01T Physics I
Prereq: —
U (Fall)
5-0-7 PHYSICS I
Credit cannot also be received for 8.01, 8.012, 8.01L, 8.01T

Elementary mechanics, presented in greater depth than in 8.01. Newton's laws, concepts of momentum, energy, angular momentum, rigid body motion, and non-inertial systems. Uses elementary calculus freely. Concurrent registration in a math subject more advanced than 18.01 is recommended. In addition to the theoretical subject matter, several experiments in classical mechanics are performed by the students in the laboratory.

A. Burgasser

8.02 Physics II
Prereq: 8.01, 8.012, 8.01L, 8.01X, or 8.01T
U (Fall, Spring)
3-2-7 PHYSICS II
Credit cannot also be received for 8.02, 8.02X

Parallel to 8.01, but more advanced mathematically. Some knowledge of vector calculus assumed. Maxwell's equations, in both differential and integral form. Electrostatic and magnetic vector potential. Properties of dielectrics and magnetic materials. In addition to the theoretical subject matter, several experiments in electricity and magnetism are performed by the students in the laboratory.

Fall: J. Winn
Spring: Staff

8.03 Physics III
Prereq: 18.02; 8.02, 8.022, or 8.02X
U (Fall, Spring)
5-0-7 REST

Mechanical vibrations and waves; simple harmonic motion, superposition, forced vibrations and resonance, coupled oscillations, and normal modes; vibrations of continuous systems; reflection and refraction; phase and group velocity. Optics; wave solutions to Maxwell's equations; polarization; Snell's Law, interference, Huygens's principle, Fraunhofer diffraction, and gratings.

Fall: R. Ashoori
Spring: Staff

8.033 Relativity
Prereq: 8.01, 18.02
U (Fall)
5-0-7

Normally taken by Physics majors in their sophomore year. Einstein's postulates; consequences for simultaneity, time dilation, length contraction, and clock synchronization; Lorentz transformation; relativistic effects and paradoxes; Minkowski diagrams; invariants and four-vectors; momentum, energy, and mass; particle collisions. Relativity and electricity;
Coulomb’s law; magnetic fields. Brief introduction to Newtonian cosmology. Introduction to some concepts of general relativity; principle of equivalence. The Schwarzschild metric; gravitational red shift; particle and light trajectories; geodesics; Shapiro delay.

T. Figueroa

8.04 Quantum Physics I
Prereq: 8.03 or 6.014; 18.03 or 18.034
U (Fall, Spring)
5-0-7 REST

Experimental basis of quantum physics: photoelectric effect, Compton scattering, photons, Franck-Hertz experiment, the Bohr atom, electron diffraction, deBroglie waves, and wave-particle duality of matter and light. Introduction to wave mechanics: Schrödinger’s equation, wave functions, wave packets, probability amplitudes, stationary states, the Heisenberg uncertainty principle, and zero-point energies. Solutions to Schrödinger’s equation in one dimension: transmission and reflection at a barrier, barrier penetration, potential wells, the simple harmonic oscillator. Schrödinger’s equation in three dimensions: central potentials and introduction to hydrogenic systems.

Fall: J. Negele
Spring: Staff

8.044 Statistical Physics I
Prereq: 8.03, 18.03
U (Spring)
5-0-7

Introduction to probability, statistical mechanics, and thermodynamics. Random variables, joint and conditional probability densities, and functions of a random variable. Concepts of macroscopic variables and thermodynamic equilibrium, fundamental assumption of statistical mechanics, microcanonical and canonical ensembles. First, second, and third laws of thermodynamics. Numerous examples illustrating a wide variety of physical phenomena such as magnetism, polyatomic gases, thermal radiation, electrons in solids, and noise in electronic devices. Concurrent enrollment in 8.04 is recommended.

Staff

8.04 Quantum Physics II
Prereq: 8.04
U (Fall)
5-0-7


I. Stewart

8.06 Quantum Physics III
Prereq: 8.05
U (Spring)
5-0-7

Continuation of 8.05. Units: natural units, scales of microscopic phenomena, applications. Time-independent approximation methods: degenerate and nondegenerate perturbation theory, variational method, Born-Oppenheimer approximation, applications to atomic and molecular systems. The structure of one- and two-electron atoms: overview, spin-orbit and relativistic corrections, fine structure, variational approximation, screening, Zeeman and Stark effects. Charged particles in a magnetic field: Landau levels and integer quantum hall effect. Scattering; general principles, partial waves, review of one-dimension, low-energy approximations, resonance, Born approximation. Time-dependent perturbation theory. Students research and write a paper on a topic related to the content of 8.05 and 8.06.

Staff

8.07 Electromagnetism II
Prereq: 8.03, 18.03
U (Fall)
4-0-8


J. Egedal-Pedersen

8.08 Statistical Physics II
Prereq: 8.044, 8.05
U (Spring)
4-0-8


Staff

8.09 Classical Mechanics II
Prereq: 8.01
4-0-8

Formal introduction to classical mechanics, Euler-Lagrange equations, Hamilton’s equations of motion used to describe central force motion, scattering, perturbation theory and Noether’s theorem. Extension to continuous and relativistic systems and classical electrodynamics.

B. Wyslouch

UNDERGRADUATE LABORATORY AND SPECIAL PROJECT SUBJECTS

8.13 Experimental Physics I
Prereq: 8.04
U (Fall)
0-6-12 Institute LAB

8.14 Experimental Physics II
Prereq: 8.05, 8.13
U (Spring)
0-6-12 Institute LAB

Four fundamental laboratory experiments are carried out each term, covering most aspects of modern physics relating to names such as Rutherford, Franck-Hertz, Hall, Ramsauer, Doppler, Fraunhofer, Faraday, Mossbauer, Compton, and Stern-Gerlach. Stresses basic experimental techniques and data analysis, and written and oral presentation of experiment results. Second term requires knowledge of quantum mechanics at the 8.05 level. 12 units may be applied to the General Institute Laboratory Requirement.

R. Yamamoto

8.18 Special Problems in Undergraduate Physics
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Opportunity for undergraduates to engage in experimental or theoretical research under the supervision of a staff member. Specific approval required in each case.

Consult D. E. Pritchard
8.19 Readings in Physics
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Supervised reading and library work. Choice of material and allotment of time according to individual needs. For students who want to do work not provided for in the regular subjects. Specific approval required in each case.
Consult D. E. Pritchard

UNDERGRADUATE ELECTIVE SUBJECTS

8.20 Introduction to Special Relativity
Prereq: 8.01, 18.01
U (IAP)
2-0-7 REST
Credit cannot be received for 8.20 if credit for 8.033 is or has been received in the same or prior terms.
Introduces the basic ideas and equations of Einstein’s special theory of relativity. Topics include Lorentz transformations, length contraction and time dilation, four vectors, Lorentz invariants, relativistic energy and momentum, relativistic kinematics, Doppler shift, space-time diagrams, relativity paradoxes, and some concepts of general relativity. Intended for freshmen and sophomores. Not usable as a restricted elective by Physics majors.
Staff

8.22 J Interactive Introduction to Nuclear Magnetic Resonance (New)
(Same subject as 22.920 J)
Prereq: 18.02
G (IAP)
1-2-0 H-LEVEL Grad Credit
See description under subject 22.920 J.
D. G. Cory, S. D. Sewell

8.224 Exploring Black Holes: General Relativity and Astrophysics
Prereq: 8.033 or 8.20
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9
Study of physical effects in the vicinity of a black hole as a basis for understanding general relativity, astrophysics, and elements of cosmology. Extension to current developments in theory and observation. Energy and momentum in flat space-time; the metric; curvature of space-time near rotating and nonrotating centers of attraction; trajectories and orbits of particles and light; elementary models of the Cosmos. Weekly meetings include an evening seminar and recitation. The last third of the semester is reserved for collaborative research projects on topics such as the Global Positioning System, solar system tests of relativity, descending into a black hole, gravitational lensing, gravitational waves, Gravity Probe B, and more advanced models of the cosmos. Subject has online components that are open to selected MIT alumni. Alumni wishing to participate should contact Professor Bertschinger at edbert@mit.edu. Enrollment limited to 40.
E. Bertschinger

8.231 Physics of Solids I
Prereq: 8.044, 8.05
U (Fall)
4-0-8
Introduction to the basic concepts of the quantum theory of solids. Topics: periodic structure and symmetry of crystals; diffraction; reciprocal lattice; chemical bonding; lattice dynamics, phonons, thermal properties; free electron gas; model of metals; Bloch theorem and band structure, nearly free electron approximation; tight binding method; Fermi surface; semiconductors, electrons, holes, impurities; optical properties, excitons; and magnetism.
X. G. Wen

8.251 String Theory for Undergraduates
Prereq: 8.033, 8.044, 8.05
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8
Introduction to the main concepts of string theory, i.e. quantum mechanics of a relativistic string. Develops aspects of string theory and makes it accessible to students familiar with basic electromagnetism and statistical mechanics, including the study of D-branes and string thermodynamics.
B. Zwiebach

8.261 J Introduction to Computational Neuroscience
(Same subject as 9.29 J)
Prereq: 18.03 and 8.02 or permission of instructor
U (Fall)
3-0-9
See description under subject 9.29 J.
M. Fee

8.276 Nuclear and Particle Physics
Prereq: 8.05
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8
A modern view of the fundamental structure of matter. Starting from a model that views quarks as basic building blocks of mesons and baryons, the properties and interactions of these particles are established. Quantum numbers and multiplet structure of particle families. Nuclei as multibaryon systems: stability, radioactive decay, and reactions. Current topics in nuclear and particle physics research at MIT.
Staff

8.282 J Introduction to Astronomy
(Same subject as 12.402 J)
Prereq: 8.01
U (Spring)
3-0-6 REST
Quantitative introduction to physics of the solar system, stars, interstellar medium, the galaxy, and universe, as determined from a variety of astronomical observations and models. Topics: planets, planet formation; stars, the Sun, “normal” stars, star formation; stellar evolution, supernovae, compact objects (white dwarfs, neutron stars, and black holes), pulsars, binary x-ray sources; star clusters, globular and open clusters; interstellar medium, gas, dust, magnetic fields, cosmic rays; distance ladder; galaxies, normal and active galaxies, jets; gravitational lensing; large scaling structure; Newtonian cosmology, dynamical expansion and thermal history of the universe; cosmic microwave background radiation; big bang nucleosynthesis. No prior knowledge of astronomy necessary. Not usable as a restricted elective by Physics majors.
Staff

8.284 Modern Astrophysics
Prereq: 8.04, 8.05
U (Spring)
3-0-9
Applications of physics (Newtonian, statistical, and quantum mechanics) to fundamental processes that occur in celestial objects. Includes
main-sequence stars, collapsed stars (white dwarfs, neutron stars, and black holes), pulsars, supernovae, the interstellar medium, galaxies, and as time permits, active galaxies, quasars, and cosmology. Observational data discussed. No prior knowledge of astronomy is required.

Staff

8.286 The Early Universe
Prereq: 18.03, 8.02
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 REST

Introduction to modern cosmology. First half deals with the development of the big bang theory from 1915 to 1980, and latter half with recent impact of particle theory. Topics: special relativity and the Doppler effect, Newtonian cosmological models, introduction to non-Euclidean spaces, thermal radiation and early history of the universe, big bang nucleosynthesis, introduction to grand unified theories and other recent developments in particle theory, baryogenesis, the inflationary universe model, and the evolution of galactic structure.

A. Guth

8.287] Observational Techniques of Optical Astronomy
(Same subject as 12.410J)
Prereq: 8.03; 8.282J, 12.402J, 12.409 or other introductory astronomy course
U (Fall)
3-4-8 Institute LAB

See description under subject 12.410J.
J. L. Elliot

8.292] Fluid Physics
(Same subject as 12.330J)
Prereq: 8.044, 5.60, or permission of instructor
U (Spring)
3-0-9

P. Joss

8.298 Selected Topics in Physics
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Presentation of topics of current interest, with content varying from year to year.
Consult T. Greytak

8.299 Physics Teaching
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

For qualified undergraduate students interested in gaining some experience in teaching. Laboratory, tutorial, or classroom teaching under the supervision of a faculty member. Students selected by interview.
Consult D. E. Pritchard

8.3] Undergraduate Research
Prereq: —
U (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Research opportunities in physics. For further information, contact the departmental UROP coordinator.
D. E. Pritchard

8.31] Undergraduate Physics Thesis
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

Program of research leading to the writing of an SB thesis; to be arranged by the student under approved supervision.
Information: D. E. Pritchard

Graduate Subjects

8.311 Electromagnetic Theory I
Prereq: 8.07
G (Spring)
4-0-8 H-LEVEL Grad Credit

Basic principles of electromagnetism: experimental basis, electrostatics, magnetic fields of steady currents, motional emf and electromagnetic induction, Maxwell's equations, propagation and radiation of electromagnetic waves, electric and magnetic properties of matter, and conservation laws. Subject uses appropriate mathematics but emphasizes physical phenomena and principles.

Staff

8.312 Quantum Theory I
Prereq: 8.05, 8.21
G (Fall)
4-0-8 H-LEVEL Grad Credit
8.322 Quantum Theory II
Prereq: 8.07, 8.321
G (Spring)
4-0-8 H-LEVEL Grad Credit


8.321: R. Jackiw
8.322: Staff

8.323 Relativistic Quantum Field Theory I
Prereq: 8.321
G (Spring)
4-0-8 H-LEVEL Grad Credit


Staff

8.324 Relativistic Quantum Field Theory II
Prereq: 8.322, 8.323
G (Fall)
4-0-8 H-LEVEL Grad Credit

The second term of the quantum field theory sequence. Develops in depth some of the topics discussed in 8.323 and introduces some advanced material. Topics: functional path integrals; renormalization and the renormalization group; quantization of nonabelian gauge theories; BRST symmetry; renormalization and symmetry breaking; critical exponents and scalar field theory; perturbation theory anomalies.
W. Taylor
8.325 Relativistic Quantum Field Theory III  
Prereq: 8.324  
G (Spring)  
4-0-8 H-LEVEL Grad Credit  
The third and last term of the quantum field theory sequence. Its aim is the proper theoretical discussion of the physics of the standard model. Topics: quantum chromodynamics; Higgs phenomenon and a description of the standard model; deep-inelastic scattering and structure functions; basics of lattice gauge theory; operator products and effective theories; detailed structure of the standard model; spontaneously broken gauge theory and its quantization; instantons and theta-vacua; topological defects; introduction to supersymmetry.  
Staff

8.333 Statistical Mechanics I  
Prereq: 8.044, 8.05  
G (Fall)  
4-0-8 H-LEVEL Grad Credit  
8.333: M. Kardar  
8.334: Staff

8.351j Classical Mechanics: A Computational Approach  
(Same subject as 6.946j, 12.620j)  
(Same subject as 6.946j, 12.620j)  
(Subject meets with 12.008)  
Prereq: 8.01, 18.03, 6.001, or equivalent  
G (Fall)  
3-3-6 H-LEVEL Grad Credit  
See description under subject 12.620j.  
J. Wisdom, G. J. Sussman

8.361 Quantum Theory of Many-Particle Systems  
Prereq: 8.322, 8.333  
Acad Year 2007–2008: G (Fall)  
Acad Year 2008–2009: Not offered  
3-0-9 H-LEVEL Grad Credit  
Introduces general many-body theory applicable to low temperature, nuclear, and solid-state physics. Reviews occupation number representation and classical Mayer expansion. Perturbation theory; diagrammatic expansions and linked-cluster theorem for zero or finite temperature systems of fermions or bosons. Green’s functions; analytic properties, equations of motion, relation to observables, approximations, linear response theory, and random phase approximation. Superconductivity: electron-phonon interaction, instability of normal state, BCS ground state, perturbation theory.  
T. W. Donnelly

8.371j Quantum Information Science  
(Same subject as 6.443j, MAS.865j)  
Prereq: 2.11 or 8.05; 6.050j or 18.06  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
See description under subject MAS.865j.  
I. Chuang

8.381, 8.382 Selected Topics in Theoretical Physics  
Prereq: Permission of instructor  
G (Fall, Spring)  
3-0-9 H-LEVEL Grad Credit  
Topics of current interest in theoretical physics, varying from year to year. Subject not routinely offered; given when sufficient interest is indicated.  
Consult P. A. Lee

8.391, 8.392 Special Problems in Graduate Physics  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Advanced problems in any area of experimental or theoretical physics, with assigned reading and consultations.  
Consult R. Ashoori

8.395j Teaching College-Level Science  
(Same subject as 5.95j, 7.59j, 18.094j)  
Prereq: —  
G (Spring)  
2-0-2 [P/D/F]  
See description under subject 5.95j.  
L. Breslow

8.398 Selected Topics in Graduate Physics  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Presentation of topics of current interest with content varying from year to year.  
Consult T. Greynak

8.399 Physics Teaching  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
For qualified graduate students interested in gaining some experience in teaching. Laboratory, tutorial, or classroom teaching under the supervision of a faculty member. Students selected by interview.  
Consult R. Yamamoto

Physics of Atoms, Radiation, Solids, Fluids, and Plasmas

8.421 Atomic and Optical Physics I  
Prereq: 8.05  
Acad Year 2007–2008: G (Spring)  
Acad Year 2008–2009: Not offered  
3-0-9 H-LEVEL Grad Credit  
The first of a two-term subject sequence that provides the foundations for contemporary research in selected areas of atomic and optical physics. The interaction of radiation with atoms: resonance; absorption, stimulated and spontaneous emission; methods of resonance, dressed atom formalism, masers and lasers, cavity quantum electrodynamics; structure of simple atoms, behavior in very strong fields; fundamental tests: time reversal, parity violations, Bell’s inequalities; and experimental methods.  
Staff

8.422 Atomic and Optical Physics II  
Prereq: 8.05  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
3-0-9 H-LEVEL Grad Credit  
The second of a two-term subject sequence that provides the foundations for contemporary research in selected areas of atomic and optical physics. Non-classical states of light- squeezed states; multi-photon processes, Raman scattering; coherence- level crossings, quantum beats, double resonance, superradiance; trapping and cooling- light forces, laser cooling, atom optics, spectroscopy of trapped atoms and ions; atomic interactions- classical collisions, quantum scat-
tering theory, ultracold collisions; and experimental methods.

Staff

8.431J Nonlinear Optics
(Same subject as 6.634J)
Prereq: 6.013 or 8.07
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 6.634J.
E. P. Ippen, J. G. Fujimoto

8.481, 8.482 Selected Topics in Physics of Atoms and Radiation
Prereq: 8.321
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit

Presentation of topics of current interest, with content varying from year to year. Subject not routinely offered; given when sufficient interest is indicated.
Consult P. A. Lee

8.511 Theory of Solids I
Prereq: 8.231
G (Fall)
3-0-9 H-LEVEL Grad Credit

P. A. Lee

8.512 Theory of Solids II
Prereq: 8.511
G (Spring)
3-0-9 H-LEVEL Grad Credit

Staff

8.513 Many-Body Theory for Condensed Matter Systems
Prereq: 8.05, 8.08, 8.033, 8.231J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Concepts and physical pictures behind various phenomena that appear in interacting many-body systems. Visualization occurs through concentration on path integral, mean-field theories and semiclassical picture of fluctuations around mean-field state. Topics covered: interacting boson/fermion systems, Fermi liquid theory and bosonization, symmetry breaking and nonlinear sigma-model, quantum gauge theory, quantum Hall theory, mean-field theory of spin liquids and quantum order, string-net condensation and emergence of light and fermions.

Staff

8.514 Strongly Correlated Systems in Condensed Matter Physics
Prereq: 8.322, 8.333
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Study of condensed matter systems where interactions between electrons play an important role. Topics vary depending on lecturer but may include low-dimension magnetic and electronic systems, disorder and quantum transport, magnetic impurities (the Kondo problem), quantum spin systems, the Hubbard model and high-temperature superconductors. Topics are chosen to illustrate the application of diagrammatic techniques, field-theory approaches, and renormalization group methods in condensed matter physics.
L. Levittov

8.575J Statistical Thermodynamics of Complex Liquids
(Same subject as 10.44J, 22.52J)
Prereq: 8.08, 10.213
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit

See description under subject 10.44J.
D. Blankshtein, S. H. Chen

8.581, 8.582 Selected Topics in Condensed Matter Physics
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9
Can be repeated for credit

Presentation of topics of current interest, with contents varying from year to year. Subject not routinely offered; given when sufficient interest is indicated.
Consult P. A. Lee

8.591J Systems Biology
(Same subject as 7.81J, 9.531J)
Prereq: —
G (Fall)
3-0-9

Introduction to mathematical modeling techniques to address key questions in modern biology. Overview of modeling techniques in molecular biology and genetics, cell biology and developmental biology. Description of key experiments that validate mathematical models. Topics include molecular systems biology—constructing and modeling of genetic networks, control theory and genetic networks, lambda phage as a genetic switch, synthetic genetic switches, bacterial chemotaxis, genetic oscillators, and circadian rhythms; cellular systems biology—reaction diffusion equations, local activation and global inhibition models, gradient sensing systems, and center-finding networks; developmental systems biology—general pattern formation models, modeling cell-cell communication, quorum sensing, and models for Drosophila development.
A. Van Oudenaarden

8.592J Statistical Physics in Biology
(Same subject as HST.452J)
Prereq: 8.333 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

M. Kardar, L. Mirny

8.593J Biological Physics
(Same subject as HST.450J)
Prereq: 8.044 recommended but not necessary
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit

Designed to provide seniors and first-year graduate students with a quantitative, analytical understanding of selected biological phenomena. Topics include experimental and theoretical
basis for the phase boundaries and equation of state of concentrated protein solutions, with application to diseases such as sickle cell anemia and cataract. Protein-ligand binding and linkage and the theory of allosteric regulation of protein function, with application to proteins as stores as transporters in respiration, enzymes in metabolic pathways, membrane receptors, regulators of gene expression, and self-assemblying scaffolds. The physics of locomotion and chemoreception in bacteria and the biophysics of vision, including the theory of transparency of the eye, molecular basis of photo reception, and the detection of light as a signal-to-noise discrimination. G. Benedek

8.594j Introduction to Neural Networks
(Same subject as 9.641j)
Prereq: 9.29 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 9.641j.
H. S. Seung

8.613j Introduction to Plasma Physics I
(Same subject as 6.651j, 22.611j)
Prereq: 6.013, 8.07, or 22.105; 18.04 or 18.075
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 22.611j.
R. Parker, I. Hutchinson, J. Freidberg

8.614j Introduction to Plasma Physics II
(Same subject as 6.652j, 22.612j)
Prereq: 6.651j, 8.613j, or 22.611j
G (Spring)
3-0-9 H-LEVEL Grad Credit
Linear waves and instabilities in magnetized plasma; solutions of Vlasov-Maxwell equations in homogeneous and inhomogeneous plasmas; conservation principles for energy and momentum; quasi-linear theory and nonlinear stabilization; solitons and coherent nonlinear phenomena; collisions and discrete particle effects; fluctuations in a stable plasma; Fokker-Planck equation and transport phenomena. A subject description tailored to fit the background and interests of the attending students distributed shortly before and at the beginning of the subject.
Staff

8.624 Plasma Waves
Prereq: 8.613j
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Comprehensive theory of electromagnetic waves in a magnetized plasma. Wave propagation in cold and hot plasmas. Energy flow. Absorption by Landau and cyclotron damping and by transit time magnetic pumping (TTMP). Wave propagation in inhomogeneous plasma: accessibility, WKB theory, mode conversion, connection formulae, and Budden tunneling. Applications to RF plasma heating, wave propagation in the ionosphere and laser-plasma interactions. Wave propagation in toroidal plasmas, and applications to ion cyclotron (ICRF), electron cyclotron (ECRH), and lower hybrid (LHH) wave heating, Quasi-linear theory and applications to RF current drive in tokamaks. Extensive discussion of relevant experimental observations.
Staff

8.641 Physics of High-Energy Plasmas I
Prereq: 8.613j
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
8.642 Physics of High-Energy Plasmas II
Prereq: 8.613j
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Basic concepts of plasmas, with temperatures of thermonuclear interest, relevant to fusion research and astrophysics. Microscopic transport processes due to interparticle collisions and collective modes (e.g., microinstabilities). Relevant macroscopic transport coefficients (electrical resistivity, thermal conductivities, particle “diffusion”). Runaway and slide-away regimes. Magnetic reconnection processes and their relevance to experimental observations. Radiation emission from inhomogeneous plasmas. Conditions for thermonuclear burning and ignition (D-T and “advanced” fusion reactions, plasmas with polarized nuclei). Role of “impurity” nuclei. “Finite β” (pressure) regimes and ballooning modes. Convective modes in configuration and velocity space. Trapped particle regimes. Nonlinear and explosive instabilities. Interaction of positive and negative energy modes. Each subject can be taken independently.
Staff

8.681, 8.682 Selected Topics in Fluid and Plasma Physics
Prereq: 8.613j
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Presentation of topics of current interest, with content varying from year to year. Subject not routinely offered; given when interest is indicated.
Consult M. Porkolab

Nuclear and Particle Physics

8.701 Introduction to Nuclear and Particle Physics
Prereq: 8.321, 8.322
G (Spring)
3-0-9 H-LEVEL Grad Credit
The phenomenology and experimental foundations of particle and nuclear physics; the fundamental forces and particles, composites. Interactions of particles with matter, and detectors. SU(2), SU(3), models of mesons and baryons. QED, weak interactions, parity violation, lepton-nucleon scattering, and structure functions. QCD, gluon field and color. W and Z fields, electro-weak unification, the CKM matrix. Nucleon-nucleon interactions, properties of nuclei, single- and collective-particle models. Electron and hadron interactions with nuclei. Relativistic heavy ion collisions, and transition to quark-gluon plasma.
Staff

8.711 Nuclear Physics
Prereq: 8.322, 8.701
G (Fall)
4-0-8 H-LEVEL Grad Credit
A modern, advanced subject in experimental foundations and theoretical understanding of the structure of nucleons and nuclei. Exploring the information obtained with hadron and lepton probes from low to high energies. Hadron structure: form factors, spin structure, and quark content. Nucleon-nucleon scattering: phenomenological and meson exchange potentials, and effective field theory approach. Nuclear properties: saturation, single particle and collective motion, isospin, electromagnetic and weak transitions, core polarization, electron scattering, sum rules, and pair correlations. Nuclear models for structure and reactions: shell and collective models, Hartree-Fock, optical and Fermi gas models, and nuclear resonances. Probing properties of bound, relative to free, nucleons:
form factors, and EMC effect. Relativistic heavy ion physics and the quark-gluon plasma.
J. Matthews

8.712 Advanced Topics in Nuclear Physics
Prereq: 8.711 or permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Subject for experimentalists and theorists with rotation of the following topics: (1) Nuclear chromodynamics—introduction to QCD, structure of nucleons, lattice QCD, phases of hadronic matter; and relativistic heavy ion collisions. (2) Medium-energy physics—nuclear and nucleon structure and dynamics studied with medium- and high-energy probes (neutrinos, photons, electrons, nucleons, pions, and kaons). Studies of weak and strong interactions.
Staff

8.781, 8.782 Selected Topics in Nuclear Theory
Prereq: 8.323
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Presents topics of current interest in nuclear structure and reaction theory, with content varying from year to year. Subject not routinely offered; given when sufficient interest is indicated.
Consult R. L. Jaffe

8.811 Particle Physics
Prereq: 8.701
G (Fall)
3-0-9 H-LEVEL Grad Credit
Survey of current research in high energy physics. Topics include electron-positron and proton-antiproton collisions; electroweak phenomena, heavy-flavor physics, and high-precision tests of the standard model. Other topics include searches for new phenomena (compositeness, supersymmetry, and GUTs), discussion of our new experimental results (e.g., the top quark), and expectations from future accelerators (B factory, LHC).
M. Chen

8.821 String Theory
Prereq: 8.324
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
An introduction to string theory. Basics of conformal field theory; light-cone and covariant quantization of the relativistic bosonic string; quantization and spectrum of supersymmetric 10-dimensional string theories; T-duality and D-branes; toroidal compactification and orbifolds; 11-dimensional supergravity and M-theory.
J. McGreevy

8.831j Supersymmetric Quantum Field Theories
(Same subject as 18.396j)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
See description under subject 18.396j.
Information: D. Z. Freedman

8.841 Electroweak Interactions
Prereq: 8.324
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
An introduction to the standard model of electroweak interactions and beyond; neutrino interactions and masses; the CKM matrix; lepton scattering off of nucleons and nuclei; the search for the Higgs boson; supersymmetric extension of the standard model. Topics vary with instructor.
Staff

8.851 Strong Interactions
Prereq: 8.324
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
The strong force which binds quarks together is described by a relativistic quantum field theory called quantum chromodynamics (QCD). Subject surveys: The QCD Langrangian, asymptotic freedom and deep inelastic scattering, jets, the QCD vacuum, instantons and the U(1) problem, lattice gauge theory, and other phases of QCD.
Staff

8.861 Advanced Topics in Superfluidity
Prereq: 8.324
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Basic pairing theory, effective field theory and spontaneous symmetry breaking; well-established applications to liquid helium 3 as a warm-up; research will be explored including anisotropic superconductivity in heavy fermion systems and cuprates; color superconductivity in high-density QCD; and pairing in fermion systems with mismatched Fermi surfaces, including ultracold atom systems. Additional ideas needed to discuss the fractional quantum Hall effect will be reviewed, emphasizing its connection to conventional superfluidity, and pointing toward aspects of anyon behavior potentially relevant for quantum information processing.
F. Wilczek

8.871, 8.872 Selected Topics in Theoretical Particle Physics
Prereq: 8.323
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Presents topics of current interest in theoretical particle physics, with content varying from year to year. Subject not routinely offered; given when sufficient interest is indicated.
Consult E. Farhi

8.881, 8.882 Selected Topics in Experimental Particle Physics
Prereq: 8.811
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Presents topics of current interest in experimental particle physics, with content varying from year to year. Subject not routinely offered; given when sufficient interest is indicated.
Consult P. Fisher

Space Physics and Astrophysics

8.901 Astrophysics I
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Staff

8.902 Astrophysics II
Prereq: 8.901
G (Fall)
3-0-9 H-LEVEL Grad Credit
Galactic dynamics: potential theory, orbits, collisionless Boltzmann equation, etc. Galaxy

R. Simcoe

8.913 Plasma Astrophysics I
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

8.914 Plasma Astrophysics II
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

For students interested in space physics, astrophysics, and plasma physics in general. Magnetospheres of rotating magnetized planets, ordinary stars, neutron stars, and black holes. Pulsar models: processes for slowing down, particle acceleration, and radiation emission; accreting plasmas and x-ray stars; stellar winds; heliosphere and solar wind- relevant magnetic field configuration, measured particle distribution in velocity space and induced collective modes; stability of the current sheet and collisionless processes for magnetic reconnection; theory of collisionless shocks; solitons; Ferroaro-Rosenbluth sheet; solar flare models; heating processes of the solar corona; earth’s magnetosphere (auroral phenomena and their interpretation, bowshock, magnetotail, trapped particle effects); relationship between gravitational (galactic) plasmas and electromagnetic plasmas. 8.913 deals with heliospheric, 8.914 with extra-heliospheric plasmas.

B. Coppi

8.921 Stellar Structure and Evolution
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Observable stellar characteristics; overview of observational information. Principles underlying calculations of stellar structure. Physical processes in stellar interiors; properties of matter and radiation; radiative, conductive, and convective heat transport; nuclear energy generation; nucleosynthesis; and neutrino emission. Protostars; the main sequence, and the solar neutrino flux; advanced evolutionary stages; variable stars; planetary nebulae, supernovae, white dwarfs, and neutron stars; close binary systems; and abundance of chemical elements.

Staff

8.942 Cosmology
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Thermal backgrounds in space. Cosmological principle and its consequences: Newtonian cosmology and types of “universes”; survey of relativistic cosmology; horizons. Overview of evolution in cosmology; radiation and element synthesis; physical models of the “early stages.” Formation of large-scale structure to variability of physical laws. First and last states. Some knowledge of relativity expected. 8.962 recommended though not required.

Staff

8.952 Particle Physics of the Early Universe
Prereq: 8.323, 8.324
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Basics of general relativity, standard big bang cosmology, thermodynamics of the early universe, cosmic background radiation, primordial nucleosynthesis, basics of the standard model of particle physics, electroweak and QCD phase transition, basics of group theory, grand unified theories, baryon asymmetry, monopoles, cosmic strings, domain walls, axions, inflationary universe, and structure formation.

Staff

8.962 General Relativity
Prereq: 18.03, 18.06, 8.07
G (Spring)
4-0-8 H-LEVEL Grad Credit

The basic principles of Einstein’s general theory of relativity, differential geometry, experimental tests of general relativity, black holes, and cosmology.

Staff

8.971, 8.972 Astrophysics Seminar
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Advanced seminar on current topics, with a different focus each semester. Typical topics: gravitational lenses, active galactic nuclei, neutron stars and pulsars, galaxy formation, supernovae and supernova remnants, brown dwarfs, and extrasolar planetary systems. The presenter at each session is selected by drawing names from a hat containing those of all attendees. Offered if sufficient interest is indicated.

Consult E. W. Bertschinger

8.981, 8.982 Selected Topics in Astrophysics
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Topics of current interest, varying from year to year. Subject not routinely offered; given when sufficient interest is indicated.

Consult P. Schechter

8.7H Graduate Physics Thesis
Prereq: —
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research leading to the writing of an SM, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member.

Consult R. Ashoori
9.00 Introduction to Psychology
Prereq: —
U (Spring)
4-0-8 REST
A survey of the scientific study of human nature, including how the mind works, and how the brain supports the mind. Topics include the mental and neural bases of perception, emotion, learning, memory, cognition, child development, personality, psychopathology, and social interaction. Consideration of how such knowledge relates to debates about nature and nurture, free will, consciousness, human differences, self and society. Enrollment limited to 300.
J. D. Gabrieli

9.01 Introduction to Neuroscience
Prereq: —
U (Fall)
4-0-8 REST
Introduction to the mammalian nervous system, with emphasis on the structure and function of the human brain. Topics include the function of nerve cells, sensory systems, control of movement, learning and memory, and diseases of the brain.
M. Bear, H. S. Seung

9.011 Systems Neuroscience
Prereq: Permission of instructor; admission to BCS graduate program
G (Fall)
6-0-12 H-LEVEL Grad Credit
Survey of principles underlying the structure and function of the nervous system, with a focus on systems approaches. Topics: development of the nervous system and its connections, sensory systems of the brain, the motor system, higher cortical functions, behavioral and cellular analyses of learning and memory. A survey of brain and behavioral studies for first-year graduate students.
E. K. Miller, M. Wilson, Staff

9.012 Cognitive Science
Prereq: Permission of instructor
G (Spring)
6-0-12 H-LEVEL Grad Credit
Intensive survey of cognitive science. Topics include visual perception, language, memory, cognitive architecture, learning, reasoning, decision-making, and cognitive development. Topics covered from behavioral, computational, and neural perspectives.
E. Gibson, P. Sinha, J. Tenenbaum

9.013 Cellular and Molecular Neurobiology
(Same subject as 7.68)
Prereq: 9.01 or permission of instructor
G (Spring)
6-0-12 H-LEVEL Grad Credit
Major areas of cellular and molecular neurobiology including excitable cells and membranes, ion channels and receptors, synaptic transmission, cell-type determination, axon guidance, neuronal cell biology, neurotrophin signaling and cell survival, synapse formation and neural plasticity. Includes lectures and exams, and involves presentation and discussion of primary literature. Focuses on major concepts and recent advances in experimental neuroscience.
M. Sheng, M. Constantine-Paton, W. Quinn

9.02 Systems Neuroscience Laboratory
Prereq: 9.01
U (Spring)
2-4-6 Institute LAB
Credit cannot also be received for 9.12
Consists of a series of laboratories designed to give students experience with basic techniques for conducting systems neuroscience research. Includes sessions on anatomical, neurophysiological, and data acquisition and analysis techniques, and ways these techniques are used to study nervous system function. Training in the art of scientific writing and oral presentation with feedback designed to improve writing and speaking skills. Assignments include two major lab reports, one formal oral presentation, and a series of basic computer programming tutorials (MATLAB). Involves the use of experimental animals. Enrollment limited.
J. J. DiCarlo, C. I. Moore, S. Jhaveri

9.03 Neural Basis of Learning and Memory
Prereq: 9.01
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9
Highlights the interplay between cellular and molecular storage mechanisms and the cognitive neuroscience of memory. Emphasis on human and animal models of hippocampal mechanisms and function. Lectures and discussion of papers. Alternate years.
M. Wilson, S. Corkin

9.036 The Visual System
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
The organization of the mammalian visual system and the manner in which shape, color, texture, motion, and depth are processed. Alternate years.
P. H. Schiller

9.04 Neural Basis of Vision and Audition
Prereq: 9.01 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9
Examines the neural bases of visual and auditory processing for perception and sensorimotor control. Focuses on physiological and anatomical studies of the mammalian nervous system as well as behavioral studies of animals and humans. Studies visual pattern, color and depth perception, auditory responses and speech coding, and spatial localization. Alternate years.
P. H. Schiller, M. C. Brown

9.044 Brain Mechanisms for Hearing and Speech
(Same subject as HST.722)
Prereq: HST.723 or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit
See description under subject HST.722.
M. C. Brown, B. Delgutte, F. Guenther, J. Melcher

9.05 Neural Basis of Movement
Prereq: 9.01 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9
Surveys general principles and specific examples of motor control in biological systems. Emphasizes the neural mechanisms underlying
different aspects of movement and movement planning. Covers sensory reception, reflex arcs, spinal cord organization, pattern generators, muscle function, locomotion, eye movement, and cognitive aspects of motor control. Functions of central motor structures, including cerebellum, basal ganglia, and cerebral cortex. Cortical plasticity, motor learning and computational approaches to motor control, and motor disorders are discussed. Alternate years.

A. Graybiel, M. Sur, E. Bizzi, C. Moore

9.07 Statistics for Brain and Cognitive Science
Prereq: 18.01 and 18.02 or permission of instructor
U (Fall)
3-0-9
A survey introduction to statistical reasoning and statistical methods relevant to neuroscience and cognitive science research. Core topics include introductions to probability theory, estimation theory, hypothesis testing, linear models, the generalized linear model, and experimental design. Additional topics chosen from Monte Carlo methods, Bayesian methods, time-series analysis, spectral analysis, and point processes theory. Emphasis on developing a firm conceptual understanding of the statistical paradigm and statistical methods primarily through analyses of actual experimental data.
E. N. Brown

9.073] Statistics for Neuroscience Research
(Same subject as HST.660J)
Prereq: 9.07 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9
A survey of statistical methods for neuroscience research. Core topics include introductions to the theory of point processes, the generalized linear model, Monte Carlo methods, Bayesian methods, multivariate methods, time-series analysis, spectral analysis and state-space modeling. Emphasis on developing a firm conceptual understanding of the statistical paradigm and statistical methods primarily through analyses of actual experimental data. Alternate years.
E. N. Brown

9.09] Cellular Neurobiology
(Same subject as 7.29J)
Prereq: 7.05
U (Spring)
4-0-8
See description under subject 7.29J.
W. G. Quinn, J. T. Littleton

9.10 Cognitive Neuroscience
Prereq: 9.01
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9
Explores the cognitive and neural processes that support attention, vision, language, motor control, navigation, and memory. Introduces basic neuroanatomy, functional imaging techniques, and behavioral measures of cognition. Discusses methods by which inferences about the brain bases of cognition are made. Consider evidence from patients with neurological diseases (Alzheimer’s disease, Parkinson’s disease, Huntington’s disease, Balint’s syndrome, amnesia, and focal lesions from stroke) and from normal human participants. Students prepare PowerPoint presentations summarizing journal articles. Alternate years.
S. Corkin

9.110] Neurology, Neuropsychology, and Neurobiology of Aging
(Same subject as 7.92J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Lectures and discussions explore the clinical, behavioral, and molecular aspects of brain aging processes in humans. Topics include loss of memory and other cognitive abilities in normal aging; neurodegenerative conditions such as Parkinson’s and Alzheimer’s diseases. Based on lectures, readings taken from the primary literature, and discussions. Students are expected to present topics based on their readings. One written midterm test and one final examination. Alternate years.
S. Corkin

9.12 Experimental Molecular Neurobiology
Prereq: 9.01; 7.012, 7.013, 7.014, or 7.015
U (Fall)
2-4-6 Institute LAB
Credit cannot also be received for 9.02
Experimental techniques in cellular and molecular neurobiology. Designed for students without previous experience in techniques of cellular and molecular biology. Experimental approaches include tissue culture of neuronal cell lines, dissection and culture of brain cells, DNA manipulation, synaptic protein analysis, immunocytochemistry, and fluorescent microscopy. One lab session plus one paper review session per week. Enrollment limited.
C. Lois, Y. Hayashi

9.14 Brain Structure and Its Origins
Prereq: 9.01 or permission of instructor
U (Spring)
3-0-9
Outline of mammalian functional neuroanatomy, aided by studies of comparative neuroanatomy and evolution and of brain development. Topics include early steps to a central nervous system, basic patterns of brain and spinal cord connections, regional development and differentiation, regeneration, motor and sensory pathways and structures, systems underlying motivations, innate action patterns, formation of habits, and various cognitive functions, and lab techniques. Optional brain dissections.
G. E. Schneider

9.15 Biochemistry and Pharmacology of Synaptic Transmission
(Subject meets with 9.150)
Prereq: 9.01, 7.05, or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9
9.150] Biochemistry and Pharmacology of Synaptic Transmission
(Subject meets with 9.15)
Prereq: 9.011 or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit
Considers the process of neurotransmission, especially chemicals used in the brain and elsewhere to carry signals from nerve terminals to the structures they innervate. Focuses on monoamine transmitters (acetylcholine; serotonin; dopamine and norepinephrine); also examines amino acid and peptide transmitters and neuro-modulators like adenosine. Macromolecules that mediate neurotransmitter synthesis, release, inactivation and receptor-mediated actions are discussed, as well as factors that regulate their activity and the second-messenger systems and ion fluxes that they control. The involvement of particular neurotransmitters in human diseases is considered. Alternate years.
R. J. Wurtman

9.161 Cellular Neurophysiology
Prereq: 9.011 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Surveys the mechanisms of neuronal communication. Covers ion channels in excitable membrane, single cell computation, synaptic transmission, and synaptic plasticity. Correlates the properties of ion channels and synaptic transmission with their physiological function. Discusses the organizational principles for
the formation of functional neural networks at synaptic and cellular levels. Involves discussion of primary literature. Juniors and seniors require instructor’s permission.

Y. Amitai

9.173J Noninvasive Imaging in Biology and Medicine
(Same subject as 20.483J, 22.56J, HST.561J)
Prereq: 18.03, 8.03, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 22.56J.
A. Jasanoff

9.18 Developmental Neurobiology
(Subject meets with 7.69J, 9.181J)
Prereq: 9.01, 7.03, 7.05, or permission of instructor
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
4-0-8

9.181J Developmental Neurobiology
(Same subject as 7.69J)
(Subject meets with 9.18)
Prereq: 9.011 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit
Considers molecular control of neural specification, formation of neuronal connections, construction of neural systems, and the contributions of experience to shaping brain structure and function. Topics include: neural induction and pattern formation, cell lineage and fate determination, neuronal migration, axon guidance, synapse formation and stabilization, activity-dependent development and critical periods, development of behavior. In addition to final exam, analysis and presentation of research papers required for final grade. Additional readings required for graduate credit. Alternate years.
E. Nedivi

9.20 Animal Behavior
Prereq: 9.00 or permission of instructor
U (Fall)
3-0-9 HASS
Most of the major categories of adaptive behavior can be seen in all animals. Begins with evolution of behavior, the driver of nervous system evolution, reviewed using concepts developed in ethology, sociobiology, other comparative studies, and in studies of brain evolution. Considers the roles of various types of plasticity as well as foraging and feeding, defensive and aggressive behavior, courtship and reproduction, migration and navigation, social activities and communication, with contributions of inherited patterns and cognitive abilities. Studies in both field and laboratory reviewed; human behavior considered in the context of primate studies.
G. E. Schneider

9.205 Neurobiology of Animal Behavior
Prereq: 9.011 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-7
Seminar explores the biological basis of animal behavior, focusing on its physiological, anatomical, and genetic mechanisms. Topics include genetic control of cast behavior in honeybees, echolocation in bats, specification in cichlids, vocal learning in birds, magnetoreception in birds and mammals, electrophysiology in fish, pheromone reception in mammals, prey location in owls, and navigation control in insects. Critical reading of the relevant literature and presentations by the students. Alternate years. Enrollment limited to 10.
C. Lois

9.22J A Clinical Approach to the Human Brain
(Same subject as HST.422J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9
Introduction to normal and abnormal human brain functioning, including the cellular basis of activity-dependent development, critical periods, and plasticity of the brain through learning; neurotransmitters and emotional disorders; fMRI studies of vision, language, dyslexia, motor function, pain, placebo effects, and emotional states. Implications for education, prevention of dementia and dyslexia. Enrollment limited to 25.
T. N. Byrne

9.24J Diseases of the Nervous System
(Same subject as HST.424J)
Prereq: 9.01
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9
Topics examined include regional functional anatomy of the CNS through imaging and stroke; degenerative diseases such as Parkinson’s and Alzheimer’s; immunological disorders such as multiple sclerosis and paraneoplastic syndromes; epilepsy; and gliomas. Emphasis on diseases for which a molecular mechanism is understood. Clinical and pathological findings, differential diagnosis, genetics, pathophysiology, and treatment are discussed for individual diseases. Enrollment limited to 25.
T. N. Byrne

9.272J Topics in Neural Signal Processing
(Same subject as HST.576J)
Prereq: —
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9
Presents signal processing and statistical methods used to study neural systems and analyze neurophysiological data. Topics include state-space modeling formulated using the Bayesian Chapman-Kolmogorov system, theory of point processes, EM algorithm, Bayesian and sequential Monte Carlo methods. Applications include dynamic analyses of neural encoding, neural spike train decoding, studies of neural receptive field plasticity, algorithms for neural prosthetic control, EEG and MEG source localization. Students should know introductory probability theory and statistics. Alternate years.
E. N. Brown

9.285J Neural Coding and Perception of Sound
(Same subject as HST.723J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject HST.723J.
B. Delgutte, M. C. Brown, J. J. Guinan, J. Melcher

9.29J Introduction to Computational Neuroscience
(Same subject as 8.261J)
Prereq: 18.03 and 8.02 or permission of instructor
U (Fall)
3-0-9
Mathematical introduction to the biophysics and circuits underlying neural computation. Topics include neuronal excitability, dendrites and cable theory, models of synaptic transmission, single-neuron dynamics, oscillators and sequence generation, and computation and dynamics in simple neuronal networks. Concepts applied to simple computing circuits in the behaving animal.
M. Fee

9.301J Neural Plasticity in Learning and Memory
(Same subject as 7.98J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Examination of the role of neural plasticity during learning and memory of invertebrates and mammals. Detailed critical analysis of the current literature of molecular, cellular, genetic, electrophysiological, and behavioral studies. Student-directed presentations and discussions of original papers supplemented by introductory...
9.31 The Neurophysiology of Memory (New)
Prereq: 9.01
U (Fall)
4-0-8
Surveys the basic mechanisms of communication between neurons, with a focus on how this communication is altered by learning in several systems. Examines cellular and behavioral forms of associative memory, including classical conditioning in Aplysia, fear conditioning in rodents, eyeblink conditioning in rabbits, and striatal-based reward learning in rodents. Completion of 9.09 is recommended but not required.
K. Goosens

9.32J Genetic Neurobiology
(Same subject as 7.67J)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Specific functions of neurons, the interactions of neurons in development, and the organization of neuronal ensembles to produce behavior, by functional analysis of mutations and molecular analysis of their genes. Concentrates on work with nematodes, fruit flies, mice, and humans.
W. G. Quinn, J. T. Littleton

9.34J Perception, Knowledge, and Cognition
(Same subject as MAS.234J)
Prereq: 9.00 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-6
The acquisition and communication of knowledge demands a coherent cognitive framework within which we can reason about events and states in the world. Subject examines what frameworks are plausible, and how these choices affect our deductive and creative processes. Material includes world regularities and perceptual inference, causal reasoning, representational forms, belief structures, mental models, man-machine control, and discourse.
W. A. Richards

9.34J Cognitive Architectures
(Same subject as MAS.654J)
Prereq: Permission of instructor
G (Fall)
3-3-6 H-LEVEL Grad Credit
Knowledge acquisition, communication, and successful behaviors require adequate models of the world. Actions based on such models depend on values assigned to state variables, which are derived from a creature’s beliefs and goals. How beliefs may be acquired, updated, or aggregated in decision-making is formalized using a graphical framework called an Anigraf. The framework is analogous to a society of agents with different beliefs and goals who strive to reach collective decisions for actions. Exposure to Bayesian, causal, analogical, logical, and game-theoretic frameworks also included.
W. A. Richards

9.35 Sensation and Perception
Prereq: 8.02 and 18.02 or permission of instructor
U (Spring)
4-0-8
How senses work and how physical stimuli get transformed into signals in the nervous system. Examines how the brain uses those signals to determine what’s out there in the world. All the senses are discussed with emphasis on vision. Topics include perception of color, motion, form, and depth. Graduate students are expected to complete additional work.
E. H. Adelson

9.357 Special Topics in Vision Science
Prereq: Permission of instructor
G (Fall)
2-0-7 H-LEVEL Grad Credit
Can be repeated for credit
An advanced seminar on issues of current interest in human and machine vision. Topics vary from year to year. Participants discuss current literature as well as their ongoing research.
E. H. Adelson

9.364 Research in Cognitive Architectures
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Human models of the world are based on observed regularities in the behavior of events and actions. Such cognitive models play a dominant role not only in perception, but also in thought. Research projects address the structure of such models, and how they are manipulated and used.
W. A. Richards

9.37J Anigrafs
(Same subject as MAS.235J)
Prereq: 9.34 or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9
Many complex systems can be represented as a society of agents who aggregate information to reach a collective decision. An Anigraf makes explicit how one agent’s knowledge is related to another’s, and how the form of these relationships affect the social choice. Simulations are used to discover emergent properties of different Anigraf models. Topics include elementary graph theory, network designs, partial orders, voting strategies, coordination games, and dynamics of choice. Applied examples taken from insect societies, neural networks, studies of co-evolution, cognition, and group decision-making.
W. Richards

9.41 Topics in Neuroscience and Cognitive Science (New)
Prereq: Permission of instructor
U (Fall, Spring)
2-12-4
Emphasizes research and scientific communication; instruction and practice in written and oral communication provided. Students use data gathered during their research to develop skills in scientific communication, with emphasis on research papers and proposals. Students make oral presentations on their research, including an individual poster presentation at the end of the course, and read and critique published research papers. The subject is continued over two consecutive terms, with emphasis on laboratory research in the fall and on communication in the spring. Students must have completed at least one semester of a faculty-sponsored research project for credit prior to registration in 9.41.
P. Sinha, S. Jhaiveri, M. Ogren

9.472J Neuroimaging Cells and Circuits (New)
(Same subject as 20.472J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
Offers an introduction to imaging methods at the forefront of modern neurobiology. Emphasis is placed on in vivo imaging in the context of neural systems research. Specific topics covered include classical optics, fluorescence and fluorescent dyes, multiphoton microscopy, reflectance-based imaging methods, functional and anatomical magnetic resonance imaging, and molecular neuroimaging. Both applications and underlying principles are discussed, and lectures are supplemented by demonstrations of imaging techniques in the laboratory. Alternate years. Enrollment limited to 15.
A. Jasanoff, P. T. So
9.50 Research in Brain and Cognitive Sciences
Prereq: 9.00 or permission of instructor
U (Fall, Spring, Summer)
2-8-2 Institute LAB
Can be repeated for credit
Laboratory research in brain and cognitive science, using physiological, anatomical, pharmacological, developmental, behavioral, and computational methods. Each student carries out an experimental study under the direction of a member of the faculty. Project must be approved in advance by faculty supervisor and either M. Potter or P. H. Schiller. Written presentation of results is required.
Consult M. Potter or P. H. Schiller

9.51–9.52 Topics in Brain and Cognitive Sciences
Prereq: 9.00 and any other two subjects in Brain and Cognitive Sciences
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Opportunity for undergraduate study in Brain and Cognitive Sciences not included in other subject listings.
Consult M. Potter

9.520 Statistical Learning Theory and Applications
Prereq: 6.867, 6.041, 18.06, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Focuses on the problem of supervised and unsupervised learning from the perspective of modern statistical learning theory, starting with the theory of multivariate function approximation from sparse data. Develops basic tools such as regularization, including support vector machines for regression and classification. Derives generalization bounds using both stability and VC theory. Discusses current research topics such as boosting, feature selection, active learning, ranking, and online learning. Examines applications in several areas: computer vision, computer graphics and bioinformatics. Final projects and hands-on applications and exercises, paralleling the rapidly increasing practical uses of the techniques described in the subject.
T. Poggio, J. Bouvrie, R. Rifkin

9.531J Systems Biology
(Same subject as 7.81J, 8.591J)
Prereq: —
G (Fall)
3-0-9
See description under subject 8.591J.
A. Van Oudenaarden

9.56J Abnormal Language
(Same subject as 24.907J)
Prereq: 24.900 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9
Introduction to the linguistic study of language pathology, concentrating on experimental approaches and theoretical explanations. Discussion of Specific Language Impairment, Down syndrome, William’s syndrome, normal aging, Parkinson’s disease, Alzheimer’s disease, hemispherectomy, and aphasia. Focuses on the comparison of linguistic abilities among these syndromes, while drawing clear comparisons with first- and second-language acquisition. Topics include the lexicon, morphology, syntax, semantics, and pragmatics. Relates the lost linguistic abilities in these syndromes to properties of the brain. Alternate years.
K. Wexler

9.57J Language Acquisition
(Same subject as 24.904J)
Prereq: 24.900 or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Covers the major results in the study of first-language acquisition concentrating on the development of linguistic structure, including morphology, syntax, and semantics. Universal aspects of development are discussed, as well as a variety of cross-linguistic phenomena. Theories of language learning are considered, including parameter-setting and maturation. Alternate years.
K. Wexler

9.587J The Lexicon and Its Features
(Same subject as 6.543J, 24.941J, HST.727J)
Prereq: 24.901 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 24.941J.
D. Gow, D. Steriade, K. N. Stevens, S. Shattuck-Hufnagel

9.59J Psycholinguistics
(Same subject as 24.905J)
Prereq: 9.00, 24.900 or permission of instructor
U (Spring)
3-0-9 HASS
Central topics in language processing. The structure of language. Sentence processing. Discourse processing. Morphological processing. The storage and access of words in the mental dictionary. Speech processing. The relationship between the computational resources available in working memory and the language processing mechanism. Ambiguity resolution. Discussion of computational modeling, including connectionist models. The relationship between language and thought. Issues in language acquisition including critical period phenomena, the acquisition of speech, and the acquisition of words. Experimental methodologies such as self-paced reading, eye-tracking, cross-modal priming, and neural imaging methods.
E. Gibson

9.591J Language Processing
(Same subject as 24.945J)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Seminar in real-time language comprehension. Models of sentence and discourse comprehension from the linguistic, psychological, and artificial intelligence literature, including symbolic and connectionist models. Ambiguity resolution. Linguistic complexity. The use of lexical, syntactic, semantic, pragmatic, contextual, and prosodic information in language comprehension. The relationship between the computational resources available in working memory and the language processing mechanism. The psychological reality of linguistic representations.
E. Gibson

9.601J Language Acquisition I
(Same subject as 24.949J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Lectures, reading, and discussion of current theory and data concerning the psychology and biology of language acquisition. Emphasizes learning of syntax, semantics, and morphology, together with some discussion of phonology, and especially research relating grammatical theory and learnability theory to empirical studies of children.
K. Wexler

9.61 Laboratory in Higher Level Cognition (New)
Prereq: 9.35, 9.59, 9.65, 9.66, or 9.85; or permission of instructor
U (Spring)
3-6-3 Institute LAB
How to design, conduct, analyze and present experiments on higher-level cognition. Students construct, conduct, analyze and present two experimental projects, including one original and independent experimental project of publishable quality. Exercises to develop skills in
reading and writing scientific research reports in cognitive science cover evaluating the methods section of a published paper, reading and understanding graphical displays and statistical claims about data, and evaluating theoretical claims based on experimental data. Topics of research include social cognition and theory of mind, cognitive development, learning, induction, and moral cognition. Examples of experimental projects include testing (1) the structure of visual statistical learning and its relationship to causal learning, (2) how other people’s eye-gaze directs an observer’s attention, (3) how people represent other people’s actions in cooperative and competitive contexts, (4) the role of intentions in moral reasoning, and (5) the stability of cooperation in economic games with a possibility for errors. Enrollment limited to 18.

R. Saxe

9.611J Natural Language and the Computer Representation of Knowledge
(Same subject as 6.863J)
Prereq: 6.034
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 6.863J.

R. C. Berwick

9.63 Laboratory in Visual Cognition
Prereq: Permission of instructor
U (Fall)
3-6-3 Institute LAB

Teaches principles of experimental methods in human visual perception and attention, including design and statistical analysis. Combines lectures and hands-on experimental exercises; requires three independent experimental projects. To foster improved writing and presentation skills in conducting and critiquing research in cognitive science, students are required to provide several individual reports on experimental designs, as well as to write articles and give oral presentations of three team experiments. Enrollment limited to 20.

A. Oliva

9.641J Introduction to Neural Networks
(Same subject as 8.594J)
Prereq: 9.29 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit


H. S. Seung

9.65 Cognitive Processes
Prereq: 9.00
U (Spring)
3-0-9 HASS

An introduction to human information processing and learning. Topics include the nature of mental representation and processing; the architecture of memory; pattern recognition; attention; imagery and mental codes; concepts and prototypes; reasoning and problem-solving.

M. C. Potter

9.66] Computational Cognitive Science
(Same subject as 6.804J)
(Subject meets with 9.660)
Prereq: 9.07, 18.05, 6.041, or permission of instructor
U (Fall)
3-0-9

9.660 Computational Cognitive Science
(Subject meets with 6.804J, 9.66J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Introduction to computational theories of human cognition. Focuses on principles of inductive learning and inference, and the representation of knowledge. Computational frameworks include Bayesian and hierarchical Bayesian models, probabilistic graphical models, non-parametric statistical models and the Bayesian Occam’s razor, sampling algorithms for approximate learning and inference, and probabilistic models defined over structured representations such as first-order logic, grammars, or relational schemas. Applications to understanding core aspects of cognition, such as concept learning and categorization, causal reasoning, theory formation, language acquisition, and social inference. Graduate students complete a final project.

J. B. Tenenbaum

9.675 The Development of Object and Face Recognition
Prereq: 9.012 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

A ‘back to the beginning’ view to better understand the end result. What might be the developmental processes that lead to the organization of ‘booming, buzzing confusions’ into coherent visual objects? Examines key experimental results and computational proposals pertinent to the discovery of objects in complex visual inputs. In-depth discussions of research articles. Enrollment limited to 15.

P. Sinha

9.68 Affect: Biological, Psychological, and Social Aspects of “Feelings”
Prereq: 9.00
U (Spring)
2-2-8 HASS

Affect is to cognition and behavior as feeling is to thinking and acting or as values are to beliefs and practices. Considers these relations, both at the psychological level of organization and in terms of their neurobiological and sociocultural counterparts. In addition to attending weekly class sessions and doing regular homework assignments, students are required to participate in small study groups that meet for two hours per week.

S. L. Chorover

9.70 Social Psychology
Prereq: —
U (Spring)
3-2-7 HASS

Examines interpersonal and group dynamics, considers how the thoughts, feelings, and actions of individuals are influenced by (and influence) the beliefs, values, and practices of large and small groups. Learning occurs through a combination of in-class activities complemented by participation in small study groups and completion of regular homework assignments. Also involves occasional lectures and demonstrations.

S. L. Chorover

9.71 Functional MRI of High-Level Vision
Prereq: 9.07; 9.34, 9.35, 9.65, 9.66, or permission of instructor
U (Fall)
3-0-9

Basics of fMRI, the strengths and limitations of fMRI compared to other techniques, and the design and analysis of fMRI experiments, focusing primarily on experiments on high-level vision. Upon completion, students should be able to understand and critique published fMRI papers, have a good grasp of what is known about high-level vision from fMRI, and design their own fMRI experiments. Enrollment limited to 15.

N. G. Kanwisher
9.720 The Neural Basis of Visual Object Recognition in Monkeys and Humans  
Prereq: —  
G (Fall)  
3-0-9  
Key issues of object representation and data from primate physiology and human fMRI that bear on those issues. Topics include computational problems of object representation, the nature of object representations in the brain, tolerance and selectivity of those representations, and the effects of attention and learning. Enrollment limited to 15.  
J. J. DiCarlo, N. G. Kanwisher

9.75] Psychology of Gender and Race  
(Same subject as SP.650J)  
Prereq: —  
U (Fall, Spring)  
3-0-9 HASS  
Examines evidence (and lack thereof) regarding when and how an individual’s thoughts, feelings, and actions are affected by gender and race. Topics include gender and racial factors in identity development, cognition and emotion, achievement, stereotypes, physical and mental health, sexuality, close relationships, work, and violence. Fall 2007 topic: U.S. focus on race and gender. Spring 2008 topic: International focus on gender, ethnicity and trauma. Enrollment limited to 20.  
C. Kapungu

9.85 Infant and Early Childhood Cognition  
Prereq: 9.00  
U (Fall)  
3-0-9 HASS  
Introduction to cognitive development focusing on children’s understanding of objects, agents, and causality. Develops a critical understanding of experimental design. How developmental research might address philosophical questions about the origins of knowledge, appearance and reality, and the problem of other minds.  
L. Schulz

9.91 Topics in Brain and Cognitive Sciences  
Prereq: 9.00 and any other two subjects in Brain and Cognitive Sciences  
U (Fall, IAP, Spring, Summer)  
Units arranged  
Can be repeated for credit  
Individual study of a special topic under the direction of a member of the faculty.  
Consult E. Nedivi

9.911–9.917 Special Topics in Brain and Cognitive Sciences  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Opportunity for graduate study of advanced subjects in Brain and Cognitive Sciences not included in other subject listings. 9.911 is taught P/D/F.  
Staff

9.919 Teaching Brain and Cognitive Sciences  
Prereq: —  
G (Fall, Spring)  
Units arranged [P/D/F]  
Can be repeated for credit  
For teaching assistants in Brain and Cognitive Sciences, in cases where teaching assignment is approved for academic credit by the department.  
Staff

9.92 Topics in Brain and Cognitive Sciences  
Prereq: 9.00  
U (Fall, Spring)  
Units arranged  
Can be repeated for credit  
Opportunity for undergraduate study in Brain and Cognitive Sciences not included in other subject listings.  
Consult E. Nedivi

9.921 Research in Brain and Cognitive Sciences  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Guided research under the sponsorship of individual members of the faculty. Ordinarily restricted to candidates for the doctoral degree in Course 9.  
Staff

9.931 Research Reports  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
0-0-6 [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Course 9 graduate students submit written reports of their research efforts according to stated deadlines. Registration is mandatory in Fall term of the third year.  
Staff

9.941 Graduate Thesis Proposals  
Prereq: 9.931  
G (Fall, Spring, Summer)  
0-0-6 [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Course 9 graduate students submit written proposals for thesis according to stated deadlines. Registration is mandatory in Fall term of the fourth year.  
Staff

9.93–9.99 Independent Activities  
Prereq: —  
U (IAP)  
Units arranged [P/D/F]  
Can be repeated for credit  
For undergraduates taking Course 9 IAP subjects for credit. See IAP Guide for details.  
Consult E. Nedivi

9.THG Graduate Thesis  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Program of research leading to the writing of a PhD thesis; to be arranged by the student and an appropriate MIT faculty member.  
Staff

9.UR Undergraduate Research  
Prereq: —  
U (Fall, IAP, Spring, Summer)  
Units arranged [P/D/F]  
Can be repeated for credit

9.URG Undergraduate Research  
Prereq: —  
U (Fall, IAP, Spring, Summer)  
Units arranged  
Can be repeated for credit  
Individual participation in an ongoing research project.  
Consult M. Potter

PSYCHOLOGY  
The undergraduate program in Psychology is described in Part 2.
10.04 Energy: An Intellectual History
Prereq: —
U (Spring)
3-0-9
Philosophic and historical approach to conceptions of energy through the 19th century. Relation of long standing scientific and philosophic problems in the field of energy to 21st century debates. Topics include the development of thermodynamics and kinetic theories, the foundation of the scientific project, the classical view of energy, and the harnessing of nature. Authors include Bacon, van Boltzmann, Carnot, Compte, Descartes, Gibbs, Plato, Aristotle, Leibniz, Kant, Hegel, Mill, Peirce, Whitehead, and Maxwell. Key texts and controversies form topics of weekly writing assignments and term papers.
B. L. Trout, L. D. Perlman

10.10 Introduction to Chemical Engineering
Prereq: 5.11, 5.111, 5.112, or 3.091; 8.01, 18.01
U (Fall, Spring)
4-0-8
The diverse applications of chemical engineering are explored through example problems. Solutions require application of fundamental concepts of mass and energy conservation to batch and continuous systems, involving chemical and biological processes. Computer skills and the elements of engineering design are taught in the context of these example problems. The objective is to acquaint the student with the field of chemical engineering and to enable use of computer methods to solve chemical and biological engineering problems.
H. H. Sawin, W. H. Green, Geo. Stephanopoulos, K. J. Prather, M. S. Strano

10.22 Molecular Engineering
Prereq: 5.60, 10.213
U (Spring)
3-0-9
Introduces molecular concepts in relation to engineering thermodynamics. Includes topics in statistical mechanics, molecular description of gases and liquids, property estimation, description of equilibrium and dynamic properties of fluids from molecular principles, and kinetics of activated processes. Also covers some basic aspects of molecular simulation and applications in systems of engineering interest.
G. C. Rutledge, P. S. Doyle

10.25 Industrial Chemistry and Chemical Process Pathways
Prereq: 5.11, 5.111, or 5.112; 10.213; 10.37
G (Fall)
3-0-6 H-LEVEL Grad Credit
Chemical and engineering principles involved in creation and operation of viable industrial processes. Topics: analysis of process chemistry by p-pathways (i.e., radical, ionic, and pericyclic reactions of organic syntheses) and d-pathways (i.e., catalysis by transition-metal complexes). Use of reaction mechanisms for inference of co-product formation, kinetics, and equilibria: process synthesis logic related to reaction selectivity, recycle, separations. Illustrations drawn from current and contemplated commercial practice.
P. S. Virk

10.26 Chemical Engineering Projects Laboratory
Prereq: 5.310 or 7.02; 10.302
U (Spring)
3-8-4
Projects in applied chemical engineering research. Students work in teams on one project for the term. Projects often suggested by local industry. Includes training in research planning and project management, execution of experimental work, data analysis, oral presentation skills and individual report writing, and team-building.

10.27 Chemical Engineering Processes Laboratory
Prereq: 5.310, 10.32, and 10.37
U (Fall)
2-8-5
Introduces practical chemical and biological engineering unit operations through experience with pilot-scale equipment and processes and theory of selected unit operations. Team building; experimentation and data analysis; and individual report writing and oral presentations.
Staff

10.28 Chemical-Biological Engineering Laboratory
Prereq: 5.310, 7.02, or 10.702; and 7.05 or 5.07, or permission of instructor
U (Fall)
2-8-5
Credit cannot also be received for 10.28L
Introduces the complete design of the bioprocess: from vector selection to production, separation, and characterization of recombinant products. Utilize concepts from many fields, such as, chemical and electrical engineering, and biology. Student teams work through parallel modules spanning microbial fermentation and animal cell culture. With the bioreactor at the core of the experiments, students study cell metabolism and biological pathways, kinetics of cell growth and product formation, oxygen mass transport, scale-up and techniques for the design of process control loops. Introduces novel bioreactors and powerful analytical instrumentation. Downstream processing and recombinant product purification also included. Enrollment limited.
J. F. Hamel, D. I. C. Wang, K. J. Prather

10.28L Chemical-Biological Engineering Laboratory
Prereq: 5.310, 7.02, or 10.702; and 7.05 or 5.07, or permission of instructor
U (IAP, Spring)
2-8-5
Credit cannot also be received for 10.28L
Same as 10.28, but with the lab portion of the class held during IAP. Content, depth, and difficulty are otherwise identical to that of 10.28. The class is designated as 10.28 on students’ transcripts. The IAP portion will be graded “T”
10.29 Biological Engineering Projects Laboratory
Prereq: 5.310, 7.02, or 10.702; 10.302
U (Spring)
3-8-4
Projects in applied biological engineering research. Students work in teams on one project for the term. Projects often suggested by local industry. Includes training in research planning and project management, execution of experimental work, data analysis, oral presentation skills and report writing, and team-building.
C. K. Colton, J. F. Hamel, C. L. Cooney

10.301 Fluid Mechanics
Prereq: 18.03, 10.10
U (Spring)
4-0-8 REST
P. S. Virk, W. M. Deen

10.302 Transport Processes
Prereq: 5.60, 10.301, 10.213, or permission of instructor
U (Fall)
4-0-8
Principles of heat and mass transfer. Steady and transient conduction and diffusion. Radiative heat transfer. Convective transport of heat and mass in both laminar and turbulent flows. Emphasis on the development of a physical understanding of the underlying phenomena and upon the ability to solve real heat and mass transfer problems of engineering significance.
C. K. Colton, K. A. Smith, W. H. Dalzell

10.32 Separation Processes
Prereq: 10.213, 10.302
U (Spring)
2-0-4
W. H. Dalzell

10.333 Introduction to Modeling and Simulation
Engineering School-Wide Elective Subject.
(Prereq: 10.213; 18.361, 22.00, HST.558)
Prereq: 18.03
U (Spring)
3-0-9 REST
See description under subject 22.00.
M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Radovitzky, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

10.34 Numerical Methods Applied to Chemical Engineering
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Numerical methods for solving problems arising in heat and mass transfer, fluid mechanics, chemical reaction engineering, and molecular simulation. Topics: numerical linear algebra, solution of nonlinear algebraic equations and ordinary differential equations, solution of partial differential equations (e.g. Navier-Stokes), numerical methods in molecular simulation (dynamics, geometry optimization). All methods are presented within the context of chemical engineering problems. Familiarity with structured programming is assumed.
W. H. Green

10.37 Chemical Kinetics and Reactor Design
Prereq: 5.60, 10.301
U (Spring)
3-0-6
Applies the concepts of reaction rate, stoichiometry and equilibrium to the analysis of chemical and biological reacting systems. Derivation of rate expressions from reaction mechanisms and equilibrium or steady state assumptions. Design of chemical and biochemical reactors via synthesis of chemical kinetics, transport phenomena, and mass and energy balances. Topics: chemical/biochemical pathways; enzymatic, pathway and cell growth kinetics; batch, plug flow and well-stirred reactors for chemical reactions and cultivations of microorganisms and mammalian cells; heterogeneous and enzymatic catalysis; heat and mass transport in reactors, including diffusion to and within catalyst particles and cells or immobilized enzymes.
Gr. Stephanopoulos, K. D. Wittrup, W. H. Green

10.390 Process Design
Prereq: 5.11, 5.111, or 5.112; 10.213; 10.301
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9
Presentation and discussion of process design case studies, selected from a variety of areas in which chemical engineers work. Emphasis on the applications of engineering science to the solution of real problems, including conceptual design and analysis leading to optimal solutions. Discussion of the trade-offs inherent in design, including economics, environmental impact, and contextual issues. Review of required engineering science and presentation of the basics of process economics.
Staff

10.391 Sustainable Energy
(Same subject as 1.818J, 2.65J, 11.371J, 22.811J, ESD.166J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
Assessment of current and potential energy systems, covering extraction, conversion and end-use, with emphasis on meeting regional and global energy needs in the 21st century in a sustainable manner. Examination of energy technologies in each fuel cycle stage for fossil (oil, gas, synthetic), nuclear (fission and fusion) and renewable (solar, biomass, wind, hydro, and geothermal) energy types, along with storage, transmission, and conservation issues. Focus on evaluation and analysis of energy technology systems in the context of political, social, economic, and environmental goals. Open to upperclass undergraduates.
M. W. Golay, J. W. Tester, J. P. Freidberg

10.392 Fundamentals of Advanced Energy Conversion
(Subject meets with 2.62J, 22.40J)
Prereq: 2.006 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
See description under subject 2.62J.
A. F. Ghoniem, M. Kazimi, Y. Shao-Horn, J. Tester

10.393 Multiscale Analysis of Advanced Energy Processes
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged H-LEVEL Grad Credit
Motivation, approach and overall methodology, and specific options for achieving a more sus-
tainable energy supply with lower environmental impacts. Case studies designed to explore multiscale aspects of new energy technology development. Four, 2-week subject modules explore diverse aspects of new energy technology development. Modules include nuclear power for electricity and hydrogen production, conventional and synthetic fossil fuels and carbon sequestration, conversion of biomass into transportation fuels and energy, and geothermal energy recovery and conversion to electricity.

J. W. Tester, M. Golay, E. Drake

10.40 Chemical Engineering Thermodynamics
Prereq: 5.60, 10.213
G (Fall)
4-0-8 H-LEVEL Grad Credit

Basic postulates of classical thermodynamics. Application to transient open and closed systems. Criteria of stability and equilibria. Constitutive property models of pure materials and mixtures emphasizing molecular-level effects using the formalism of statistical mechanics. Phase and chemical equilibria of multicomponent systems. Applications emphasized through extensive problem work relating to practical cases.

J. W. Tester, B. L. Trout, D. Blankschtein

10.42 Special Topics in Advanced Thermodynamics
Prereq: 10.40
G (IAP)
2-0-4 H-LEVEL Grad Credit

Critical point phenomena, supercritical fluids, and solution models for mixtures of electrolytes and non-electrolytes using a statistical mechanics framework with molecular simulations employed. Applications to hydrothermal chemical processes and electrochemical processes in batteries and fuel cells. Polymer thermodynamics, and surface and potential field effects on thermodynamic properties comprise other topics.

J. W. Tester

10.43 Introduction to Interfacial Phenomena
Prereq: 10.213 or introductory subject in thermodynamics or physical chemistry
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit


D. Blankschtein

10.44j Statistical Thermodynamics of Complex Liquids
(Same subject as 8.575j, 22.52j)
Prereq: 8.08, 10.213
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit

Theory of self-assembly in surfactant-water (micellar) and surfactant-water-oil (micro-emulsion) systems. Introduction to the theory of polymer solutions. Introduction to scattering techniques, light, x-ray, and neutron scattering applied to studies of the structure and dynamics of complex liquids. Modern theory of the liquid state relevant to structured (supramolecular) liquids.

D. Blankschtein, S. H. Chen

10.44j Molecular and Engineering Aspects of Biotechnology
(Same subject as 7.37j, 20.361j)
Prereq: 20.110j/2.772j, 2.005, 3.012, or 5.60; 7.06; or permission of instructor
U (Spring)
4-0-8

See description under subject 7.37j.

H. Lodish, L. G. Griffith

10.44 Biochemical Engineering
(Subject meets with 10.542)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-6

See description under subject 10.542.

K. J. Prather

10.45 Separation Processes for Biochemical Products
(Subject meets with 10.545)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-6

See description under subject 10.545.

C. L. Cooney

10.45j Process Dynamics, Operations, and Control
Prereq: 10.302, 18.03
U (Spring)
3-0-6

Introduction to dynamic processes and the engineering tasks of process operations and control. Covers modeling the static and dynamic behavior of processes; control strategies; design of feedback, feedforward, and other control structures; model-based control; applications to process equipment.

B. S. Johnston

10.467 Polymer Science Laboratory
Prereq: 5.12, 5.310
U (Fall)
2-7-6 Institute LAB

Experiments broadly aimed at acquainting students with the range of properties of polymers, methods of synthesis, and physical chemistry. Examples: solution polymerization of acrylamide, bead polymerization of divinybenzene, interfacial polymerization of nylon 6,10. Evaluation of networks by tensile and swelling experiments. Rheology of polymer solutions and suspensions. Physical properties of natural and silicone rubber. Priority of enrollment given to Course 10 seniors and juniors.

P. T. Hammond, G. C. Rutledge

10.490 Integrated Chemical Engineering I
Prereq: 10.37
U (Fall)
3-0-5

10.491 Integrated Chemical Engineering II
Prereq: 10.490
U (Spring)
3-0-5

Presents and solves chemical engineering problems in an industrial context, with applications varying by semester. Emphasis on the integration of fundamental concepts with approaches of process design. Emphasis on problems that demand synthesis, economic analysis, and process design.

P. I. Barton, G. J. McRae, B. S. Johnston
10.492 Integrated Chemical Engineering Topics I
Prereq: 10.490 or 10.491
U (Fall) 2-0-2

10.493 Integrated Chemical Engineering Topics II
Prereq: 10.490 or 10.491
U (IAP) 2-0-2

10.494 Integrated Chemical Engineering Topics III
Prereq: 10.490 or 10.491
U (Spring) 2-0-2

Chemical engineering problems presented and analyzed in an industrial context. Emphasis on the integration of fundamentals with material property estimation, process control, product development, and computer simulation. Integration of societal issues, such as engineering ethics, environmental and safety considerations, and impact of technology on society are addressed in the context of case studies.


10.499J Tissue Engineering for Analysis, Prevention, and Treatment of Human Disease
(Same subject as 20.360J)
Prereq: 5.07 or 7.05; 7.03; 18.03; 20.110 or 5.60
U (Spring) 3-0-6

See description under subject 20.360J.

L. G. Griffith, J. G. Fox, D. Schauer

10.50 Analysis of Transport Phenomena
Prereq: 10.301, 10.302
G (Fall) 4-0-8 H-LEVEL Grad Credit

Unified treatment of heat transfer, mass transfer, and fluid mechanics, emphasizing scaling concepts in formulating models and analytical methods for obtaining solutions. Topics include conduction and diffusion, laminar flow regimes, convective heat and mass transfer, and simultaneous heat and mass transfer with chemical reaction or phase change.

W. M. Deen, P. S. Doyle

10.52 Mechanics of Fluids
Prereq: 10.50
G (Spring) 3-0-6 H-LEVEL Grad Credit

Advanced subject in fluid and continuum mechanics. Content includes kinematics, macroscopic balances for linear and angular momentum, the stress tensor, creeping flows and the lubrication approximation, the boundary layer approximation, linear stability theory, and some simple turbulent flows.

K. A. Smith

10.520 Molecular Aspects of Chemical Engineering
(Subject meets with 10.420)
Prereq: 5.13, 10.213
G (Spring) 3-0-6 H-LEVEL Grad Credit

Molecular-level engineering and analysis of chemical processes. Use of chemical bonding, reactivity, and other key concepts in the design and tailoring of organic systems. Application and development of structure-property relationships. Descriptions of the chemical forces and structural factors that govern supramolecular and interfacial phenomena for molecular and polymeric systems.

P. T. Hammond

10.521 Heterogeneous Catalysis and Catalytic Processes
Prereq: 5.13, 10.37
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit

An introduction to applied catalysis, focusing on principles of importance in the development and improvement of catalysts and their practical use in industry. Topics include adsorption phenomena, catalyst preparation, and surface characterization techniques. Application of catalyst functionality concepts for control of reaction selectivity and kinetic models. Commonality of mechanisms for significant groups of catalyzed reactions such as hydrogenation, partial oxidation, and hydrocarbon reactions catalyzed by solid acids and zeolites. Control of pollutant emissions by catalysis.

Staff

10.531J Macromolecular Hydrodynamics
(Same subject as 2.341J)
Prereq: 2.25, 10.301, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit


R. C. Armstrong, G. H. McKinley

10.534 Macrotransport Processes
Prereq: 10.50
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit

Generalized Taylor dispersion theory applied to chromatographic separation processes, flow and transport in porous media, transport properties of macromolecular solutions, and generic analyses of heterogeneous systems, including adsorption phenomena, thermal transport processes, and chemically reactive continua.

H. Brenner

10.535 Interfacial Transport Processes and Rheology
Prereq: 10.50
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit

Introduction to the theory and applications of liquid-liquid interfacial transport phenomena. General tensor analysis; interfacial statics; kinematics, and transport across and within curved, deforming interfaces; two-dimensional momentum transport processes, Newtonian and non-Newtonian interfacial stress constitutive relations, applications to surface rheology; surfactant transport and adsorption at interfaces, surface diffusion, Marangoni phenomena, interphase mass transfer; asymptotic theory of diffuse interfaces; line tension phenomena.

Staff

10.536J Thermal Hydraulics in Power Technology
(Same subject as 2.59J, 22.313J)
Prereq: 2.006, 10.302, 22.312, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 22.313J.

J. Buongiorno
10.537j Molecular, Cellular, and Tissue Biomechanics
(Same subject as 2.798j, 3.971j, 6.524j, 20.410j)
Prereq: 7.012; 2.002, 2.006, 6.013, 6.014, 10.301, or 10.302
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.410j.
A. J. Grodzinsky, P. Doyle, S. Suresh

10.538j Biomolecular Kinetics and Cellular Dynamics
(Same subject as 20.420j)
Prereq: 7.05, 7.06, 18.03
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.420j.
B. Tidor, K. D. Wittrup

10.539j Fields, Forces, and Flows in Biological Systems
(Same subject as 2.795j, 6.561j, 20.430j, HST.544j)
Prereq: 6.013, 2.005, 10.302, or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.430j.
A. J. Grodzinsky, R. D. Kamm

10.541 Kinetics of Biological and Chemical Systems
Prereq: 10.37 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
6-0-6 H-LEVEL Grad Credit
Comprehensive treatment of the kinetics of basic chemical reactions and biological processes. Subject begins with a fundamental analysis of reaction order in homogeneous reactions and proceeds with the kinetics of heterogeneous systems and catalytic reactions. Methods of measuring and calculating reaction rate constants included. After a basic stoichiometric analysis of biological reaction networks, the subject discusses kinetics of enzymatic reactions and extensions to kinetic characteristics of reaction pathways and bioreaction networks. Similarities and differences between chemical and biological kinetics discussed along with concepts of rate-limiting steps and distribution of control among several reactions in a pathway. Subject concludes with applications to the kinetic analysis of chemical and biological reaction systems in the chemical and bioprocess industries.
B. L. Trout, Gr. Stephanopoulos

10.542 Biochemical Engineering
(Subject meets with 10.442)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
Interaction of chemical engineering, biochemistry, and microbiology. Mathematical representations of microbial systems. Kinetics of growth, death, and metabolism. Continuous fermentation, agitation, mass transfer, and scale-up in fermentation systems, enzyme technology.
K. J. Prather

10.543j The Protein Folding Problem
(Same subject as 5.48j, 7.88j)
(Subject meets with 7.24a)
Prereq: 5.07 or 7.05
G (Fall)
4-2-6 H-LEVEL Grad Credit
See description under subject 7.88j.
J. A. King

10.544 Metabolic and Cell Engineering
Prereq: 5.60, 7.05, 10.302, 18.03
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit
Presentation of a framework for quantitative understanding of cell functions as integrated molecular systems. Analysis of cell-level processes in terms of underlying molecular mechanisms based on thermodynamics, kinetics, mechanics, and transport principles, emphasizing an engineering, problem-oriented perspective. Objective is to rationalize target selection for genetic engineering and evaluate the physiology of recombinant cells. Topics include cell metabolism and energy production, transport across cell compartment barriers, protein synthesis and secretion, regulation of gene expression, transduction of signals from extracellular environment, cell proliferation, cell adhesion and migration.
Gr. Stephanopoulos

10.545 Separation Processes for Biochemical Products
(Subject meets with 10.445j)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
Introduction to fundamental principles of separation operations for the recovery of products from biological processes, membrane filtration, chromatography, centrifugation, cell disruption, extraction, and process design.
C. L. Cooney

10.546j Statistical Thermodynamics with Applications to Biological Systems
(Same subject as 5.70j, 20.465j)
Prereq: 5.60 or permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 5.70j.
A. Chakraborty, J. M. Deutch

10.547j Principles and Practice of Drug Development
(Same subject as 7.547j, 15.136j, HST.920j)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject 15.136j.
T. J. Allen, C. L. Cooney, S. N. Finkelstein, R. H. Rubin, A. J. Sinskey

10.548j Tumor Pathophysiology and Transport Phenomena: A Systems Biology Approach
(Same subject as HST.525j)
Prereq: 18.03; 10.301
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
2-0-4 H-LEVEL Grad Credit
See description under subject HST.525j.
R. K. Jain

10.55 Colloid and Surfactant Science
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit
D. Blankschtein

10.551 Systems Engineering
Prereq: 10.213, 10.302, 10.37
G (Spring)
3-0-6 H-LEVEL Grad Credit
Introduction to the elements of systems engineering. Special attention devoted to those tools that help students structure and solve complex
problems. Illustrative examples drawn from a broad variety of chemical engineering topics, including product development and design, process development and design, experimental and theoretical analysis of physico-chemical process, analysis of process operations.

P. I. Barton, Geo Stephanopoulos

10.555J Bioinformatics: Principles, Methods and Applications
(Same subject as HST.940J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Introduction to bioinformatics, the collection of principles and computational methods used to upgrade the information content of biological data generated by genome sequencing, proteomics, and cell-wide physiological measurements of gene expression and metabolic fluxes. Fundamentals from systems theory presented to define modeling philosophies and simulation methodologies for the integration of genomic and physiological data in the analysis of complex biological processes. Various computational methods address a broad spectrum of problems in functional genomics and cell physiology. Application of bioinformatics to metabolic engineering, drug design, and biotechnology also discussed.

Gr. Stephanopoulos, I. Rigoutsos

10.557 Mixed-integer and Nonconvex Optimization
Prereq: 10.34 or 15.053
G (Spring)
3-0-9 H-LEVEL Grad Credit

Presents the theory and practice of deterministic algorithms for locating the global solution of NP-hard optimization problems. Recurring themes and methods are convex relaxations, branch-and-bound, cutting planes, outer approximation and primal-relaxed dual approaches. Emphasis is placed on the connections between methods. These methods will be applied and illustrated in the development of algorithms for mixed-integer linear programs, mixed-integer convex programs, nonconvex programs, mixed-integer nonconvex programs, and programs with ordinary differential equations embedded. The broad range of engineering applications for these optimization formulations will also be emphasized. Students will be assessed on homework and a term project for which examples from own research are encouraged.

P. I. Barton

10.560 Structure and Properties of Polymers
Prereq: 10.213 or permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

Review of polymer molecular structure and bulk morphology; survey of molecular and morphological influence on bulk physical properties including non-Newtonian flow, macromolecular diffusion, gas transport in polymers, electrical and optical properties, solid-state deformation, and toughness. Case studies for product design.

R. E. Cohen

10.565 Physical Chemistry of Polymers
Prereq: 5.60, 10.213, or 10.40
G (Fall)
3-0-6 H-LEVEL Grad Credit

Chains macromolecules as random coils (unperturbed, expanded) and as other shapes. Statistical thermodynamics of interpenetrating random coiling polymers in solution with application to phase separations, swelling of networks, depression of melting point. The isolated chain molecule in dilute solutions analyzed for mass or size by static methods (osmometry, light scattering, neutron scattering) and by dynamic methods (intrinsinc viscosity, size exclusion chromatography, sedimentation). Introduction to chain dynamics and to rubber elasticity.

R. E. Cohen

10.569 Synthesis of Polymers
Prereq: 5.12
G (Spring)
3-0-6 H-LEVEL Grad Credit

Studies synthesis of polymeric materials, emphasizing interrelationships of chemical pathways, process conditions, and microarchitecture of molecules produced. Chemical pathways include traditional approaches such as anionic, radical condensation, and ring-opening polymerization. New techniques, including stable free radicals and atom transfer free radicals, new catalytic approaches to well-defined architectures, and polymer functionalization in bulk and at surfaces. Process conditions include bulk, solution, emulsion, suspension, gas phase, and batch vs continuous fluidized bed. Microarchitecture includes tacticity, molecular-weight distribution, sequence distributions in copolymers, errors in chains such as branches, head-to-head addition, and peroxide incorporation.

P. T. Hammond

10.571J Atmospheric Physics and Chemistry
(Same subject as 12.806J)
Prereq: 5.61, 18.075, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 12.806J.

R. G. Prinn, G. J. McRae

10.579 Applications of Technology in Energy and the Environment
Engineering School-Wide Elective Subject.
(Offered under: 1.149, 2.63, 5.00, 10.579, 22.813, ESD.174)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 22.813.

J. Deutch, R. Lester

10.580 Solid-State Surface Science
Prereq: 10.213
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit

Structural, chemical, and electronic properties of solids and solid surfaces. Analytical tools used to characterize surfaces including Auger and photoelectron spectroscopies and electron diffraction techniques. Surface thermodynamics and kinetics including adsorption-desorption, catalytic properties, and sputtering processes. Applications to microelectronics, optical materials, and catalysis.

K. K. Gleason

10.581J Advanced Materials Processing
(Same subject as 3.52J)
(Subject meets with 3.048)
Prereq: 3.022, 3.044
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 3.52J.

C. Schuh, M. C. Flemings

10.583 Particles and Particulate Processing
Prereq: Permission of instructor
G (Spring)
3-0-6
Can be repeated for credit

Synthesis, characterization and applications of particles. Thermodynamic and kinetic stability of particle suspensions. Physical and chemical mechanisms determining behavior of particulate processing operations: flow, mixing, agglomer-
10.584j Materials and Processes for Microelectromechanical Devices and Systems
(Same subject as 2.373j, 3.48j, 6.778j, 16.288j)
Prereq: 6.152j/3.155j; permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 5.68J.

10.631 Structural Theories of Polymer Fluid Mechanics
Prereq: 10.301
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
R. C. Armstrong

10.65 Chemical Reactor Engineering
Prereq: 10.37 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Fundamentals of chemically reacting systems with emphasis on synthesis of chemical kinetics and transport phenomena. Topics include kinetics of gas, liquid, and surface reactions; quantum chemistry; transition state theory; surface adsorption, diffusion, and desorption processes; mechanism and kinetics of biological processes; mechanism formulation and sensitivity analysis. Reactor topics include nonideal flow reactors, residence time distribution and dispersion models; multiphase reaction systems; non-linear reactor phenomena. Examples are drawn from different applications, including heterogeneous catalysis, polymerization, combustion, biochemical systems, and materials processing.
K. F. Jensen, A. K. Chakraborty

10.668j Statistical Mechanics of Polymers
(Same subject as 3.941j)
Prereq: 10.568 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Concepts of statistical mechanics and thermodynamics applied to macromolecules: polymer conformations in melts, solutions, and gels; Rotational Isomeric State theory, Markov processes and molecular simulation methods applied to polymers; incompatibility and segregation in incompressible and compressible systems; molecular theory of viscoelasticity; relation to scattering and experimental measurements.
G. C. Rutledge, A. Mayes

10.675j Computational Quantum Mechanics of Molecular and Extended Systems
(Same subject as 5.675j)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
The theoretical frameworks of Hartree-Fock theory and density functional theory are presented as approximate methods to solve the many-electron problem. A variety of ways to incorporate electron correlation are discussed. The application of these techniques to calculate the reactivity and spectroscopic properties of chemical systems, in addition to the thermodynamics and kinetics of chemical processes, is emphasized. Focus on cutting edge methods to sample complex hypersurfaces, for reactions in liquids, catalysts and biological systems. Students run computations both on Athena and on multi-processor supercomputers.
B. L. Trout

10.702 Introduction to Experimental Biology and Communication
(Subject meets with 7.02)
Prereq: 7.012, 7.013, 7.014, or 7.015
U (Spring)
4-8-6 Institute LAB
Application of experimental techniques in microbiology, biochemistry, cell and developmental biology. Emphasizes integrating factual knowledge with understanding the design of experiments and data analysis to prepare the students for research projects. Development of skills critical for writing about scientific findings in modern biology. Instruction and practice in written communication provided. Concurrent registration with 7.03 or 7.05 is recommended. Enrollment limited.
D. Kim, T. Schwartz

10.74j Radiative Transfer
(Same subject as 2.58j)
Prereq: 2.51, 10.302, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.58J.
G. Chen

10.792j Proseminar in Manufacturing
(Same subject as 2.890j, 3.80j, 15.792j, 16.985j)
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
See description under subject 15.792J.
D. B. Rosenfield

10.805j Technology, Law, and the Working Environment
(Same subject as ESD.136j)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Addresses relationship between technology-related problems and the law applicable to work environment. National Labor Relations Act, Occupational Safety and Health Act. Toxic Substances Control Act, state worker’s compensation, and suits by workers in the courts discussed. Problems related to occupational health and safety, collective bargaining as a mechanism for altering technology in the workplace, job alienation, productivity, and the organization of work addressed. Prior courses or experience in the environmental, public health, or law-related areas.
N. A. Ashford, C. C. Caldart

10.806 Management in Engineering
Engineering School-Wide Elective Subject.
(Of course under: 2.96, 10.806)
(Subject meets with 2.961, 6.930j, 16.653j)
Prereq: —
U (Fall)
3-1-8
See description under subject 2.96.
A. V. d’Arbeloff, J.-H. Chun

10.807j Innovation Teams
(Same subject as 15.371j)
Prereq: Permission of instructor
G (Fall, Spring)
3-2-4
Innovation teams of science, engineering, and management students evaluate the commercial
feasibility of research generated by grants to School of Engineering faculty by the Deshpande Center for Technological Innovation. Projects cover critical aspects of commercialization such as developing an intellectual property strategy, performing competitive analysis, selecting the target application and market for the technology, identifying the appropriate business model for commercialization, designing a go-to-market plan, and choosing the sales approach to garner initial customers. Lectures address key issues of technology transfer, new venture creation, and commercialization. Students develop strong skills in communication and working in teams. Resumé and application including a brief statement of objectives are required in advance of registration to enable the best match of students with projects.

C. Cooney, E. Roberts, K. Zolot

10.816 Engineering Risk-Benefit Analysis
Engineering School-Wide Elective Subject. (Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.72.
G. E. Apostolakis

SCHOOL OF CHEMICAL ENGINEERING PRACTICE

10.80 (10.82, 10.84, 10.86) School of Chemical Engineering Practice—Technical Accomplishment
Prereq: Permission of instructor, 10.81 (10.83)
G (Fall, Spring, Summer)
0-6-0 H-LEVEL Grad Credit
Conducted at industrial field stations of the School of Chemical Engineering Practice. Group problem assignments include process development design, simulation and control, technical service, and new-product development. Grading based on technical accomplishment. Credit granted in lieu of master’s thesis. See departmental description on School of Chemical Engineering Practice for details. Enrollment limited and subject to plant availability.
T. A. Hatton

10.81 (10.83, 10.85, 10.87) School of Chemical Engineering Practice—Communication Skills and Human Relations
Prereq: Permission of instructor, 10.80
G (Fall, Spring, Summer)
0-6-0 H-LEVEL Grad Credit
Conducted at industrial field stations of the School of Chemical Engineering Practice. Group problem assignments include process development, design, simulation and control, technical service, and new-product development. Grading based on communication skills and human relations in group assignments. Credit granted in lieu of master’s thesis; see departmental description on School of Chemical Engineering Practice for details. Enrollment limited and subject to plant availability.
T. A. Hatton

GENERAL

10.90 Independent Research Problem
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
For special and graduate students who wish to carry out some minor investigation in a particular field. Subject and hours to fit individual requirements.
W. M. Deen

10.910 Independent Research Problem
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
10.911 Independent Research Problem
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
For undergraduates who wish to do a special investigation or special topic in a particular field. Topic and hours arranged.
B. S. Johnston

10.94 Special Problems in Chemical Engineering
Prereq: Permission of instructor
U (Fall)
Units arranged
Can be repeated for credit
Problem of current interest, varying from year to year.
Staff

10.95 Special Problems in Chemical Engineering
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Directed research and study of special chemical engineering problems.
W. M. Deen

10.960J Student Seminar in Polymer Science and Technology
( Same subject as 3.903J)
Prereq: —
G (Fall, Spring)
2-0-0 [P/D/F]
Can be repeated for credit
A series of seminars covering a broad spectrum of topics in polymer science and engineering, featuring both on- and off-campus speakers.
G. H. McKinley, P. S. Doyle, K. Van Vliet, D. Irvine

10.961 Seminar in Advanced Air Pollution Research
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Research seminars, presented by students engaged in thesis work in the field of air pollution. Particular emphasis given to atmospheric chemistry, mathematical modeling, and policy analysis.
G. J. McRae

10.962 Seminar in Molecular Cell Engineering
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Weekly seminar with discussion of ongoing research and relevant literature by graduate students, postdoctoral fellows, and visiting scientists on issues at the interface of chemical engineering with molecular cell biology. Emphasis is on quantitative aspects of physicochemical mechanisms involved in receptor/ligand interactions, receptor signal transduction processes, receptor-mediated cell behavioral responses, and applications of these in biotechnology and medicine.
D. A. Lauffenburger
10.963 Research, Technology and Business Development in the Chemical Processing Industries
Prereq: —
G (Spring)
2-0-4 [P/D/F]
Structure of CPI; mission, structure and management of R&D organizations; basic research-technology platforms-business creation; measuring R&D effectiveness; road-mapping: linking business and R&D strategies and plans; integrating R&D with marketing: the product-centered companies; IP strategies and portfolio of R&D projects; stage-gate processes: planning, implementing, monitoring, assessing, and controlling R&D projects; Six-Sigma for Research: R&D proposals and projects; the engineering approach to the execution of R&D projects; R&D and the globalization of CPI; creating and leveraging knowledge-assets; from discovery to the creation of business value; R&D in various segments of the CPI.
Geo. Stephanopoulos

10.970 Seminar in Molecular Computation
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Seminar allows students to present their research to other students and staff. The research topics include computational chemistry techniques, kinetics, and catalysis. Focus is on molecular-level understanding of chemical change.
W. H. Green, B. L. Trout

10.971 Seminar in Fluid Mechanics and Transport Phenomena
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Seminar series on current research on Newtonian and non-Newtonian fluid mechanics and transport phenomena, and applications to materials processing. Seminars given by guest speakers and research students.
R. C. Armstrong, G. H. McKinley, P. S. Doyle

10.972 Biochemical Engineering Research Seminar
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Seminar allows students to present their research programs to other students and staff.

The research topics include fermentation and enzyme technology, mammalian and animal cell cultivation, and biological product separation.
D. I. C. Wang, C. L. Cooney

10.973 Bioengineering
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Seminar covering topics related to current research in the application of chemical engineering principles to biomedical science and biotechnology.
C. K. Colton, W. M. Deen

10.975 Seminar in Polymer Science and Engineering
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Research seminars, presented by students engaged in thesis work in the field of polymers and by visiting lecturers from industry and academia.
R. E. Cohen, P. T. Hammond, G. C. Rutledge

10.976 Process Design, Operations, and Control
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Seminars on the state of the art in design, operations, and control of processing systems, with emphasis on computer-based tools. Discussions guided by the research interests of participating students. Topics include mathematical and numerical techniques, representational methodologies, and software development.
P. I. Barton

10.977 Advances in Bioinformatics and Metabolic Engineering
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Weekly seminars with presentations by the graduate students, postdoctoral fellows, and visiting scientists and engineers from various disciplines on the current state-of-the-art developments in bioinformatics and metabolic engineering, and their application in biotechnology and biomedical engineering. Topics include: computational methods for the upgrading of the information content of large volumes of biological data generated by genome sequencing, proteomics and cell-wide physiological measurements of gene expression and metabolic fluxes; modeling and simulation methodologies of complex biological processes, e.g., genetic regulatory networks, signal transduction and metabolic pathways; new software systems.
Geo. Stephanopoulos, Gr. Stephanopoulos

10.978 Seminar in Applied Thermodynamics, Kinetics, and Transport
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Review of current topics in phase equilibria, mass transport, and chemical kinetics. Subjects include oxidation and hydrolysis reactions, and solid-salt nucleation and solubility in supercritical water; chemical synthesis and materials processing using supercritical fluids, and equations of state in high-temperature, high-pressure aqueous systems; quantum chemistry; molecular simulations of aqueous electrolytes and gas hydrates.
J. W. Tester

10.979 Plasma Processing
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Advanced topics in plasma processing used in the fabrication of microelectronics. Emphasis placed on topics of plasma kinetics, gas-solid interactions, sputtering, and reactor design. Discussions include current research in the literature.
H. H. Sawin

10.981 Seminar in Colloid and Interface Science
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit
Review of current topics in colloid and interface science. Topics include statistical mechanics and thermodynamics of micellar solutions, self-assembling systems, and microemulsions; solubilization of simple ions, amino acids, and proteins in reversed micelles; enzymatic reactions in reversed micelles; phase equilibria in colloidal systems; interfacial phenomena in colloidal systems; biomedical aspects of colloidal systems.
D. Blankschtein, T. A. Hatton
10.982 Seminar in Experimental Colloid and Surface Chemistry
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit

In-depth discussion of fundamental physical relationships underlying techniques commonly used in the study of colloids and surfaces with a focus on recent advances and experimental applications. Topics have included the application of steady-state and time-resolved fluorescence spectroscopies, infrared spectroscopy, and scanning probe microscopies.

T. A. Hatton

10.983 Reactive Processing and Microfabricated Chemical Systems
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit

Advanced topics in synthesis of materials through processes involving transport phenomena and chemical reactions. Chemical vapor deposition, modeling, and experimental approaches to kinetics of gas phase and surface reactions, transport phenomena in complex systems, materials synthesis, and materials characterization. Design fabrication and applications of microfabricated chemical systems. Seminars by graduate students, postdoctoral associates, participating faculty, and visiting lecturers.

K. F. Jensen

10.984 Biomedical Applications of Chemical Engineering
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit

Weekly seminar with lectures on current research by graduate students, postdoctoral fellows, and visiting scientists on topics related to biomedical applications of chemical engineering. Specific topics include polymeric controlled release technology, extracorporeal reactor design, biomedical polymers, bioengineering aspects of pharmaceuticals, and biomaterials/tissue and cell interactions.

R. S. Langer

10.987 Solid Thin Films and Interfaces
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit

Current research topics and fundamental issues relating to the deposition and properties of solid thin films and interfaces. Emphasis on applying analytical techniques, such as solid-state NMR, to explore the thermodynamics and kinetics of growth, defect formation, and structural modification incurred during film growth and post processing.

K. K. Gleason

10.989 Special Topics in Biotechnology
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit

Research seminars, presented by graduate students and visitors from industry and academia, covering a broad range of topics of current interest in biotechnology. Discussion focuses on generic questions with potential biotechnological applications and the quest for solutions through a coordinated interdisciplinary approach.

G. Stephanopoulos

10.990 Introduction to Chemical Engineering Research
Prereq: —
G (Fall)
3-0-3 [P/D/F]

Introduction to research in chemical engineering by faculty of chemical engineering department. Focus is on recent developments and research projects available to new graduate students.

K. F. Jensen, W. M. Deen

10.991 Seminar in Chemical Engineering
Prereq: Permission of instructor
G (Fall)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

10.992 Seminar in Chemical Engineering
Prereq: Permission of instructor
G (Spring)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

For students working on doctoral theses.

R. C. Armstrong

10.994 Molecular Bioengineering
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit

Presentations and discussion by graduate students, postdoctoral fellows, and visiting scientists of current literature and research on the engineering of protein biopharmaceuticals. Topics include combinatorial library construction and screening strategies, antibody engineering, gene therapy, cytokine engineering, and immunotherapy engineering strategies.

K. D. Wittrup

10.995 Cellular and Metabolic Engineering
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 [P/D/F]
Can be repeated for credit

Graduate students, postdoctoral fellows, visiting scientists, and guest industrial practitioners to present their own research and highlight important advances from the literature in biochemical and bioprocess engineering. Topics of interest include metabolic engineering, novel microbial pathway design and optimization, synthetic biology, and applications of molecular biology to bioprocess development.

K. J. Prather, N. Maheshri

10.996 Cellular and Metabolic Engineering
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit

Provides credit for students studying at Cambridge University under the Undergraduate Student Exchange Program of the Cambridge-MIT Institute. Credit may be used to satisfy specific SB degree requirements by arrangement with the department.

B. S. Johnston

10.EPE UPOP Summer Practice Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPE, 2.EPE, 3.EPE, 10.EPE, 16.EPE, 22.EPE)
Prereq: 2.EPW or permission of instructor
U (Fall, Spring)
0-1-0 [P/D/F]
Can be repeated for credit

See description under subject 2.EPE.

D. K. P. Yue
10.EPR UPOP Reflective Learning Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPR, 2.EPR, 3.EPR, 10.EPR,
16.EPR, 22.EPR)
Prereq: 2.EPE or permission of instructor
U (Fall)
0-0-3 [P/D/F]
See description under subject 2.EPR.
D. K. P. Yue

10.EPW UPOP IAP Workshop
Engineering School-Wide Elective Subject.
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW,
10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]
See description under subject 2.EPW.
D. K. P. Yue

10.ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of an
SM, PhD, or ScD thesis; to be arranged by the
student and appropriate MIT faculty member.
W. M. Deen

10.ThU Undergraduate Thesis
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Program of research leading to writing an SB
thesis; topic arranged between student and MIT
faculty member.
B. S. Johnston

10.UR Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
10.URG Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Opportunity for participation in a research group,
or for special investigation in a particular field.
Topic and hours to fit individual requirements.
B. S. Johnston
UNDERGRADUATE SUBJECTS

Introductory Subjects

11.001J Introduction to Urban Design and Development
(Same subject as 4.250J)
Prereq: —
U (Fall)
3-0-9 HASS
Examines the evolving structure of cities and the way that cities, suburbs, and metropolitan areas can be designed and developed. Boston and other American cities studied to see how physical, social, political and economic forces interact to shape and reshape cities over time.
Staff

11.002J Making Public Policy
(Same subject as 17.30J)
Prereq: —
U (Fall)
4-0-8 HASS-D, Category 4, CI-H
Examines how the struggle among competing advocates shapes the outputs of government. Considers how conditions become problems for government to solve, why some political arguments are more persuasive than others, why some policy tools are preferred over others, and whether policies achieve their goals. Investigates the interactions among elected officials, think tanks, interest groups, the media, and the public in controversies over global warming, urban sprawl, Social Security, health care, education, and other issues.
J. Layzer, Staff

11.003J Methods of Policy Analysis
(Same subject as 17.303J)
Prereq: 11.002J, 17.30J, 14.01
U (Spring)
3-0-9 HASS
Provides students with an introduction to public policy analysis. Examines various approaches to policy analysis by considering the concepts, tools, and methods used in economics, political science, and other disciplines. Students apply and critique these approaches through case studies of current public policy problems.
J. M. Schuster, Staff

11.004J CityScope
(Same subject as 4.001J)
Prereq: —
U (Spring)
3-0-9 HASS
See description under subject 4.001J.
J. Fernandez, P. Thompson

11.007 Public Policy Disputes
Prereq: —
U (Spring)
3-0-9 HASS
Introduction to real-world dynamics of public policy controversies. Considers national, state, and local policy disputes, such as smoking, hazardous waste, abortion, gun control, and education. Using a case study approach, students study whether and how those disputes get resolved. Students conduct debates and simulations in addition to writing a series of short essays.
J. Layzer

11.011 The Art and Science of Negotiation
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
An introduction to bargaining and negotiation in public, business, and legal settings. Combines a “hands-on” skill-building orientation with a look at pertinent social theory. Strategy, communications, ethics, and institutional influences are examined as they influence the ability of actors to analyze problems, negotiate agreements, and resolve disputes in social, organizational, and political circumstances characterized by independent interests.
L. Susskind

11.012J The Ancient City
(Same subject as 21H.405J)
Prereq: —
U (Spring)
3-0-9 HASS
See description under subject 21H.405J.
W. Broadhead

11.013J American Urban History I
(Same subject as 21H.231J)
Prereq: —
U (Spring)
2-0-7 HASS
Seminar on the history of institutions and institutional change in American cities from roughly 1850 to the present. Among the institutions to be looked at are political machines, police departments, courts, schools, prisons, public authorities, and universities. Focuses on readings and discussions.
R. M. Fogelson

11.014J American Urban History II
(Same subject as 21H.232J)
Prereq: —
U (Fall)
2-0-7 HASS
Seminar on the history of selected features of the physical environment of urban America. Among the features considered are parks, cemeteries, tenements, suburbs, zoos, skyscrapers, department stores, supermarkets, and amusement parks. Focuses on readings and discussions.
R. M. Fogelson

11.015J Riots, Strikes, and Conspiracies in American History
(Same subject as 21H.104J)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5, CI-H
See description under subject 21H.104J.
R. M. Fogelson
11.016j The Once and Future City
(Same subject as 4.211j)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H

Examines the evolving structure of cities, the
dynamic processes that shape them, and the
significance of a city’s history for its future
development. Develops the ability to read urban
form as an interplay of natural processes and
human purposes over time. Field assignments in
Boston provide the opportunity to use, develop,
and refine these concepts. Enrollment limited.
A. Spirn

11.018 Solving the Infrastructure Crisis
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines the influence of infrastructure
planning and development on cities and regions.
Identifies the political, physical, and economic
forces that influence the construction (and
maintenance) of roads, bridges, water and
sewer lines, etc. Considers different strategies
for repairing crumbling infrastructure, including
privatization.
Consult Department Headquarters

11.019j Migration and Immigration in US
History (New)
(Same subject as 21H.221j)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

See description under subject 21H.221j.
C. Capozzola

11.020 Poverty, Public Policy, and Controversy
Prereq: —
U (Fall)
3-0-9 HASS

Introductory subject to the study of poverty,
a persistent controversial issue in the United
States, viewed from an international perspective.
Focus on how society should respond to
poverty, race, and the related issues of
the politics of welfare, out-of-wedlock births,
homelessness, crime, and drugs. Investigates
how particular research findings are brought to
controversies. Examines knowledge about
poverty and community empowerment from social
science research, and how this knowledge is
incorporated into public discourse and politics.
Experience of other countries is introduced to
make explicit the assumptions on which Amer-
ican approaches to poverty are based.
Consult Department Headquarters

11.021j Environmental Law, Policy, and
Economics: Pollution Prevention and Control
(New)
(Same subject as 1.801j, 17.393j)
(Subject meets with 1.811j, 11.630j, ESD.133j)
Prereq: —
U (Fall)
3-0-9 HASS
See description under subject 1.801j.
N. Ashford, C. Caldart

11.022j Regulation of Chemicals, Radiation,
and Biotechnology (New)
(Same subject as 1.802j)
(Subject meets with 1.812j, 11.631j, ESD.134j)
Prereq: —
U (Spring)
3-0-9
See description under subject 1.802j.
N. Ashford, C. Caldart

11.023 Bridging Cultural and Racial Differences
Prereq: —
U (Fall)
4-0-8 HASS

Explores cultural and racial stereotypes to
increase understanding and appreciation of
differences. Emphasis on developing techniques
for conflict resolution in a more diversified Amer-
ica in the next century. Attention to economic
status, residential segregation, education,
political participation, and crime through current
readings, films/videos, and guest speakers.
C. G. Williams

11.024 Great Cities
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-6 HASS

Seminar that explores the attributes of cities
that are described by a variety of sources, in-
cluding members of the class, as “great cities.”
Class concerns a variety of criteria that have
been, or might be, used to ascribe greatness
to cities, such as attractiveness, quality of life,
and richness of opportunity, and examines the
consistency and/or contradictory evidence in
judgments about cities.
J. P. de Monchaux

11.025j D-Lab: Development
(Same subject as SP.721j)
(Subject meets with 11.472)
Prereq: Permission of instructor
U (Fall)
3-2-7
See description under subject SP.721j.
A. B. Smith, B. Sanyal

11.026j Downtown
(Same subject as 21H.234j)
(Subject meets with 11.339)
Prereq: —
U (Spring)
2-0-7 HASS
See description under subject 21H.234j.
R. M. Fogelson

11.027 City to City: Comparing, Researching
and Writing about Cities
Prereq: —
U (Spring)
3-0-9 HASS

Introduction to research in urban planning.
Study a domestic and a foreign city, focussing
on a planning issue common to both. Develop a
research question; create a research strategy;
interview faculty and other field experts; write
and present findings to US and international au-
diences. Students encouraged to visit one of the
study cities for research. Enrollment limited to 10.
C. Abbanat

Specialized Subjects

11.122 Society and Environment
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines environmental policy and planning
from a societal perspective, with a focus on the
sociopolitical contexts through which individu-
als and organizations influence environmental
decision making. Topics include environmental
values, environmental movements and mobiliza-
tion, environmental justice, risk perception and
communication, and collaborative environmen-
tal planning.
J. Carmin
11.123 Big Plans
Prereq: —
U (Spring)
3-0-6 HASS
Explores social, technological, political, economic, and cultural implications of “Big Plans” in the urban context. Local and international case studies (such as Boston’s Central Artery and Curitiba, Brazil’s bus transit system) are used to understand the process of making major changes to the city fabric. The efficacy of top-down and bottom-up planning and the applicability of planning strategies across cultural boundaries are considered.
Staff

11.124 Introduction to Teaching and Learning Mathematics and Science
Prereq: —
U (Fall)
3-6-3 HASS
Through visits to schools, classroom discussions, selected readings, and hands-on activities in a variety of K-12 settings, subject explores the challenges and opportunities of teaching. Topics of study include educational technology, design and experimentation, education reform, standards and standardized testing, scientific models, methods of solving problems, student learning, and careers in education.
M. Bakhtiar

11.125 Exploring K-12 Classroom Teaching
Prereq: —
U (Spring)
3-6-3 HASS
Subject uses K-12 classroom experiences, along with student-centered classroom activities and student-led classes, to explore issues in schools and education. Topics of study include design and implementation of curriculum, addressing the needs of a diversity of students, standards in math and science, student misconceptions, methods of instruction, the digital divide, teaching through different media, and student assessment.
E. Klopfer

11.126j Economics of Education
(Subject meets with 11.249)
Prereq: 14.01
U (Spring)
4-0-8 HASS
Discusses the economic aspects of current issues in education, using both economic theory and econometric and institutional readings. Topics include discussion of basic human capital theory; the growing impact of education on earnings and earnings inequality; statistical issues in determining the true rate of return to education; the labor market for teachers, implications of the impact of computers on the demand for worker skills; the effectiveness of mid-career training for adult workers; the roles of school choice, charter schools, state standards and educational technology in improving K-12 education, and the issue of college financial aid.
F. Levy

11.127 Computer Games and Simulations for Investigation and Education
(Subject meets with 11.252)
Prereq: —
U (Spring)
3-6-3
Explores how we learn from computer games and simulations, and delves into the process of building and testing simulations. First, students investigate the design and use of games and simulations in the classroom, and the research and development issues associated with desktop computer-based, handheld computer based and non-computer based media. Students then develop their own simulations and games, study what and how others learn from them (including field testing of products), and how games and simulations can be implemented in educational settings. All levels of computer experience welcome. Graduate students are expected to complete additional assignments.
E. Klopfer

11.128 Information Technology and the US Labor Market
(Subject meets with 11.248, 14.49)
Prereq: 14.01
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8 HASS
See description under subject 11.248.
F. Levy

11.129 Educational Theory and Practice I
Prereq: 11.124
U (Fall)
3-0-9
Concentrates on core set of skills and knowledge necessary for teaching in secondary schools. Topics include educational reform, student behavior and motivation, curriculum design, and the teaching profession. Classroom observation is a key component. Assignments include readings from the educational literature, written reflections on classroom observations, and practice teaching and constructing curriculum.
First of a three course sequence necessary to complete the Teacher Education Program.
R. Gibb

11.130 Educational Theory and Practice II
Prereq: 11.129
U (IAP)
3-0-9

11.131 Education Theory and Practice III
Prereq: 11.130
U (Spring)
3-0-9
Concentrates on the theory and psychology associated with student learning. Topics include educational theory, educational psychology, and theories of learning. Assignments include readings from educational literature, written reflections on classroom observations, presentations on class topics, and practice teaching. Student teaching is a key component of 11.130, the second of a three course sequence necessary to complete the Teacher Education Program; classroom observation is a key component of 11.131, the third of the three-course sequence.
E. Klopfer

11.163j Law and Society
(Subject meets with 11.496)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H
See description under subject 21A.219j.
S. Silbey

11.164j Human Rights in Theory and Practice
(Subject meets with 11.497)
Prereq: —
U (Spring)
3-0-9
See description under subject 11.497.
B. Rajagopal

11.166 Law, Social Movements, and Public Policy: Comparative and International Experience
(Subject meets with 11.496)
Prereq: Permission of instructor
U (Fall)
3-0-9 HASS
See description under subject 11.496.
B. Rajagopal
11.167 Economic Development and Technological Capabilities
Prereq: —
U (Fall)
3-0-9 HASS
The economic growth of developing countries requires the acquisition of technological capabilities. In countries at the world technological frontier, such capabilities refer to cutting edge skills to innovate entirely new products. In developing countries, the requisite technological capabilities are broader, and include production engineering, project execution and incremental innovation to make borrowed technology work. Theories of technology acquisition are examined. The empirical evidence is taken from two sets of developing countries; the most advanced (Taiwan, Korea, India, China and Brazil) and the least advanced (Africa and Middle Eastern countries).
A. Amsden

Prereq: —
U (IAP)
Units arranged [P/D/F]
Can be repeated for credit
Prereq: —
U (IAP)
Units arranged [P/D/F]
Can be repeated for credit
Planned subjects of instruction for use during IAP only.
P. Anzer

Tutorials, Fieldwork, and Internships

11.189 Special Topics in Urban Studies and Planning
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Small-group study of special topics under staff supervision. For undergraduates wishing to pursue further study or fieldwork in specialized areas of urban studies or city and regional planning not covered in regular subjects of instruction.
Consult Head of Undergraduate Committee

11.190 Special Topics in Urban Studies and Planning
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Small-group study of special topics under staff supervision. For undergraduates wishing to pursue further study or fieldwork in specialized areas of urban studies or city and regional planning not covered in regular subjects of instruction.
Consult Head of Undergraduate Committee

Laboratories

11.188 Urban Planning and Social Science Laboratory
Prereq: Permission of instructor
U (Fall)
3-6-3 Institute LAB
Credit cannot also be received for 11.208, 11.520
An introduction to the research and empirical analysis of urban planning issues using geographic information systems. Extensive hands-on exercises provide experience with various techniques in spatial analysis and querying databases. Includes a small project on an urban planning problem involving the selection of appropriate methods, the use of primary and secondary data, computer-based modeling, and spatial analysis. Requires some computing experience. Content similar to 11.520.
J. Ferreira

11.UR Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
11.URG Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Undergraduate research opportunities in Urban Studies and Planning. For further information, consult the Departmental Coordinators.
J. Ferreira, Jr.

11.ThTJ Thesis Research Design Seminar
(Same subject as 4.THTJ)
Prereq: —
U (Fall)
3-0-9
Can be repeated for credit
Designed for students writing a thesis in Urban Studies and Planning or Architecture. Develop research topics, review relevant research and scholarship, frame research questions and arguments, choose an appropriate methodology for analysis, and draft introductory methodology sections.
C. Abbanat

11.ThT Undergraduate Thesis
Prereq: 11.ThT
U (Spring)
Units arranged
Can be repeated for credit
Program of research leading to the writing of an SB thesis. To be arranged by the student under approved supervision.
Staff

11.191, 11.192 Supervised Readings in Urban Studies
Prereq: —
U (Fall, Spring)
3-0-6
Can be repeated for credit
Reading and discussion of special topics in urban studies. By arrangement with individual members of the staff.
Staff

11.193 Special Topics in Urban Studies and Planning
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Small-group study of special topics under staff supervision. For undergraduates wishing to pursue further study or fieldwork in specialized areas of urban studies or city and regional planning not covered in regular subjects of instruction.
Consult Head of Undergraduate Committee

11.194, 11.195 Special Topics in Urban Studies and Planning
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Small-group study of special topics under staff supervision. For undergraduates wishing to pursue further study or fieldwork in specialized areas of urban studies or city and regional planning not covered in regular subjects of instruction.
Consult Head of Undergraduate Committee
11.196 Urban Fieldwork and Internships
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Practical application of city and regional planning techniques to towns, cities, and regions, including problems of replanning, redevelopment, and renewal of existing communities. Includes internships, under staff supervision, in municipal and state agencies and departments under staff supervision.
Consult M. J. Daly

11.197–11.199 IAP Special Studies in Urban Studies and Planning
Prereq: —
U (IAP)
Units arranged [P/D/F]
Can be repeated for credit
Planned subjects of instruction for use during IAP only.
P. Anzer

GRADUATE SUBJECTS

Master’s Core Subjects

11.201 Gateway: Planning Action
Prereq: —
G (Fall)
3-0-5
Ten-week module designed primarily for first semester MCP students. Introduces the evolution, politics, and ethics of modern planning. Emphasizes historical roots of contemporary problems, with cases centered on planning dilemmas in the US and other countries, as well as professional writing skills.
X. Briggs and guests

11.202 Gateway: Planning Economics
Prereq: 11.203
G (Fall)
2-0-2
Introduces applications of microeconomic theory to planning problems including urban form and structure, government’s role in urban settings and problems of housing finance.
F. Levy

11.203 Microeconomics
Prereq: —
G (Fall)
3-0-5
Introduces basic economic analysis for planning students including the functioning of markets, the allocation of scarce resources among competing uses, profit maximizing behavior in different market structures. Course illustrates theory with contemporary economic issues.
F. Levy

11.220 Quantitative Reasoning and Statistical Methods for Planning I
Prereq: Permission of instructor
G (Spring)
4-2-6
Develops logical, empirically based arguments using statistical techniques and analytic methods. Covers elementary statistics, probability, and other types of quantitative reasoning useful for description, estimation, comparison, and explanation. Emphasis on the use and limitations of analytical techniques in planning practice. Restricted to first-year MCP students.
R. Ryznar, C. Zegras

Department-wide Subjects

Methods

11.221 Quantitative Reasoning and Statistical Methods for Planning II
Prereq: 11.220 or permission of instructor
G (Spring)
3-1-8
Credit cannot also be received for 11.241
Using the analytical skills developed in 11.220, this subject extends the statistical techniques to address topics in modeling and forecasting. Emphasizes the use and limitation of modeling in planning practice. Covers techniques of multiple regression and time series analysis. Uses data sets from actual planning applications for examples and problem sets.
Staff

11.225 Argumentation and Communication
Prereq: —
G (Fall)
2-0-4
Can be repeated for credit
A writing practicum associated with 11.201 that focuses on helping students write and present their ideas in cogent, persuasive arguments and other analytical frameworks. Reading and writing assignments and other exercises stress

11.229 Advanced Writing Seminar
Prereq: —
G (Spring)
2-0-7
Can be repeated for credit
Focuses on writing and speaking skills. Students bring their writing from other classes to the workshop to practice reviewing and rewriting skills and make several oral presentations. Different types of writing including proposals, memos, thesis, press releases, and writing sound bites for the media.
C. Abbanat

11.232 The Public Policy Field: History and Dilemmas
Prereq: Permission of instructor
G (Spring)
3-0-9
Examines the evolution and challenges that define the field as an intellectual and practical project of producing change in the world, focused on policy as an instrument for governing. Covers policy design, evaluation, and discourse in the policy research literature, structured around the Oxford Handbook of Public Policy.
Consult M. Rein

11.233 Research Design for Policy Analysis and Planning
Prereq: Permission of instructor
G (Fall)
3-0-9
Develops skills in research design for policy analysis and planning. Emphasizes the logic of the research process and its constituent elements. Topics include philosophy of science, question formulation, hypothesis generation and theory construction, data collection techniques (e.g. experimental, survey, interview), ethical issues in research, and research proposal preparation. Also provides overview of different data analysis techniques. Required for first-year DUSP PhD students.
J. Carmin

11.234 Making Sense: Qualitative Methods for Designers and Planners
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-4-6
Surveys uses of qualitative methods in environmental design practice and research. Topics
include: observing environments and physical traces, observing environmental behavior, asking questions, focused interviews, standardized questionnaires, use of written archival materials, use of visual materials including photographs and maps, case studies, and comparative methods. Emphasizes use of each of these skills to collect and make sense of qualitative data.

\textit{J. Vale}

11.235 Analyzing Projects and Organizations
Prereq: 11.701 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Analyzes how organizations behave- both government and nongovernment- drawing on the literature of the sociology of organizations, political science, and public administration. Demonstrates rationality in otherwise seemingly chaotic organizational environments and implementation experience. Builds analytic skills for evaluating programs and projects, organizations, and environments. Draws equally on developing-country and developed-country literature.

\textit{J. Tendler}

11.237 Gender and Race, Work, and Public Policy
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9

Provides an analytic framework for understanding the roles that gender and race play in defining the work worlds of women and men in our society, including ways in which gender intersects with race and class. Specific workplace-related policies through a gender/race lens, including welfare policy, comparable worth, affirmative action, parental leave policy, child care policy and working time policies. Investigate ways in which these policies address gender and racial inequities, and think critically about mechanisms for change.

\textit{M. Fried, C. McDowell}

11.241 Applied Regression Analysis in Urban Planning
Prereq: 11.220 or permission of instructor
G (Spring)
3-1-2
Credit cannot also be received for 11.221

Introduces regression analysis as a quantitative approach to urban planning questions. Develops a basic understanding of the concepts and techniques. Provides opportunity for extensive hands-on exercises. Same content as first half of 11.221.

\textit{Staff}

11.248 Information Technology and the US Labor Market
(Subject meets with 11.128, 14.49)
Prereq: 14.01
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8

Combines economic theory, econometric studies, workplace case studies, and pieces of cognitive psychology to examine the impact of computerization on US employment and wages. Topics include: recent trends in wages and employment; the role of computers in demands for particular labor force skill; computers’ impact on the functioning of markets and the economy’s productivity; and the extent to which computers can help teach new skills to children and adults.

\textit{F. Levy}

11.249 Economics of Education
(Subject meets with 11.126, 14.48)
Prereq: 14.01
G (Spring)
4-0-8
See description under subject 11.126.

\textit{F. Levy}

11.252 Computer Games and Simulations for Investigation and Education
(Subject meets with 11.127)
Prereq: —
G (Spring)
3-6-3
See description under subject 11.127.

\textit{E. Klopfner}

11.255 Negotiation and Dispute Resolution in the Public Sector
Prereq: —
G (Fall)
4-0-8

Investigates social conflict and distributional disputes in the public sector. While theoretical aspects of conflict are considered, focus is on the practice of dispute resolution. Comparisons between unassisted and assisted negotiation are reviewed along with the techniques of facilitation and mediation.

\textit{L. Susskind}

11.257 Seminar on Theory-Building in Multi-Party Negotiation and Dispute Resolution
Prereq: 11.255 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit

Advanced seminar on multiparty negotiation open only to qualified graduate students. Focus on cross-disciplinary contributions to the theory of negotiation and dispute resolution. Taught in conjunction with Harvard Law School.

\textit{L. Susskind}

\textbf{Public Policy}

11.262J Organizations and Environments
(Subject meets with 11.126, 14.49)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 11.126.

\textit{E. Zuckerman}

11.265 The Comparative Politics of Urban Policy
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Familiarizes students with unresolved political conflicts and social questions plaguing urban policy makers. Main point of entry is power: who has it, who doesn’t, why, and how it affects the character of cities and urban policies. Special attention paid to local government, political parties, social movements, private sector firms, and labor organizations. Policies under examination include those related to housing, transportation, land use, employment, environment, and migration; case studies include US, European, and Latin American cities.

\textit{D. E. Davis, J. P. Thompson}
Program Group Subjects

City Design and Development

11.301J Introduction to Urban Design and Development
(Same subject as 4.252J)
Prereq: Permission of instructor
G (Fall)
3-0-9
Examines both the structure of cities and ways they can be changed. Includes historical forces that have produced cities, models of urban analysis, contemporary theories of urban design, implementation strategies. Core lectures supplemented by discussion sessions focusing on student work and field trips. Guest speakers present cases involving current projects illustrating the scope and methods of urban design practice.

D. Frenchman

11.302J Urban Design Politics
(Same subject as 4.253J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
Examines ways urban design contributes to distribution of political power and resources in cities. Investigates the nature of relations between built form and political purposes through close study of a wide variety of situations where public sector design commissions and planning processes have been clearly motivated by political pressures. Lectures and discussions focus on specific case studies of 20th-century government-sponsored designs carried out under diverse regimes in the US, Europe, and elsewhere.

L. Vale

11.303J Real Estate Development II
(Same subject as 4.254J)
Prereq: Permission of instructor
G (Spring)
6-0-9 H-LEVEL Grad Credit
Focuses on the process of programming projects for the real estate development industry including the integration of finance and marketing with physical planning and design. Contemporary product prototypes for residential and commercial projects provide a foundation for two studio projects in which interdisciplinary student teams prepare professional development proposals. Projects are interspersed with lectures, field trips, and short sketch exercises. Capstone subject integrating skills and knowledge in the MSRED program, also open to other students interested in real estate development.

D. Frenchman, P. Roth

11.304J Site and Urban Systems Planning
(Same subject as 4.255J)
Prereq: Permission of instructor
G (Spring)
2-2-8
Land inventory, analysis and the planning of sites and the infrastructure systems which serve them. Spatial organization of uses, parcellization, design of roadways, grading, utility systems, stormwater runoff, parking, traffic and off-site impacts, landscaping. Lectures on analytical techniques and examples of good site-planning practice. Assignments and a client based project.

E. Ben-Joseph

11.305 Landscape Ecology and Urban Development
Prereq: —
G (Spring)
3-0-9 [P/D/F]
Presents a framework for current landscape ecological theory, structured to encourage application in physical planning of landscapes. Case studies link theory to practice, and include both urban and rural landscapes. Science and planning are examined as social practices which rely on situated knowledge. Past and present methods of ecological planning are reviewed and critiqued in a student project. Major topics include biodiversity, cyclical processes, assessment of landscape structures, and design for sustainability.

11.306 Planning Studio
Prereq: Permission of instructor
G (Spring)
6-0-12 H-LEVEL Grad Credit
Provides experience in tackling city and regional planning problems in real world settings. Students work with local clients to define issues and synthesize approaches to change that enhances performance of the environment and improves the quality of life for users and residents. The focus of the studio changes each year; past problems have involved community development in downtown Santiago, Chile, and sustainable residential development in Shanghai.

A. Spirn

11.307 Beijing Urban Design Studio
Prereq: Permission of instructor
G (Fall)
0-18-0 H-LEVEL Grad Credit
A design and development studio involving architects and planners working in teams on a contemporary design project of importance in Beijing, China. Students analyze conditions, explore alternatives, and synthesize architectural, city design and implementation plans. Supplemented by lectures and brief study tours that expose students to history and contemporary issues of urbanism in China. Enrollment limited.

D. Frenchman, J. Wampler, Y. Chang

11.308J Advanced Seminar: Urban Nature and City Design
(Same subject as 4.213J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Examines the urban environment as a natural phenomenon, human habitat, medium of expression, and forum for action. Subject has two related, major themes: how ideas of nature influence the way cities are perceived, designed, built, and managed; and how natural processes and urban form interact and the consequences of these for human health safety and welfare. Enrollment limited.

A. Spirn

11.309J Sites in Sight: Photographing the Urban Landscape
(Same subject as 4.215J)
Prereq: —
G (Fall)
3-0-9
Explores photography as a disciplined way of seeing, or investigating urban landscapes and expressing ideas. Readings, observations, and photographs form the basis of discussions on light, detail, place, poetics, narrative, and how photography can inform design and planning.

A. Spirn

11.310J Media Technology and City Design and Development
(Same subject as 4.243J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9
Explores the potential of media technology and the Internet to enhance communication and transform city design and community development in inner-city neighborhoods. Introduces a
variety of methods for describing or representing a place and its residents, for simulating actions and changes, for presenting visions of the future, and for engaging multiple actors in the process of envisioning change and guiding action. Working with local clients, students learn tools like digital storytelling to build media rich representations of urban environments.

A. Spirn, C. McDowell

11.311J Ideal Forms of Contemporary Urbanism
(Same subject as 4.262J)
Prereq: 4.645, 4.241J, 11.330J, or permission of instructor
G (Fall)
Units arranged H-LEVEL Grad Credit
See description under subject 4.262J.
A. D’Hooghe

11.328J Urban Design Skills: Observing, Interpreting, and Representing the City
(Same subject as 4.240J)
Prereq: —
G (Fall)
3-0-9
Introduction to the methods of recording, evaluating, and communicating about the urban environment. Through visual observation, field analysis, measurements, interviews, and other means, students learn to draw on their senses and develop their ability to deduce, conclude, question, and test conclusions about how the environment is used and valued. Through the use of representational tools such as drawing, photographing, computer modeling and desktop publishing, students communicate what is observed as well as their impressions and design ideas. Intended as a foundation for future studio work in urban design.
E. Ben-Joseph

11.329 Social Theory and the City
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Explores how social theories of urban life can be related to the city’s architecture and spaces. Classic or foundational writings about the city, addressing such topics as the public realm and public space; impersonality; crowds and density; surveillance and civility: imprinting time on space; spatial justice; and the segregation of difference. Aims to generate new ideas about the city by connecting the social and the physical, using Boston as a visual laboratory. Requires term paper mediating what is read with what has been observed.
R. Sennett

11.330J Theory of City Form
(Same subject as 4.241J)
Prereq: 11.001J, 4.252J, or 11.301J
G (Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
See description under subject 4.241J.
J. Beinart

11.331J Advanced Seminar in City Form
(Same subject as 4.242J)
Prereq: 4.241J or 11.330J
G (Fall)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
See description under subject 4.242J.
J. Beinart

11.332J Urban Design Studio
(Same subject as 4.163J)
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
See description under subject 4.163J.
J. Beinart, J. P. de Monchaux, M. Dennis, A. D’Hooghe

11.333J Urban Design Seminar
(Same subject as 4.244J)
Prereq: —
G (Spring)
2-0-7
Core lectures and student research focus on defining the future forms and function of the city and directions in urban design. Examines case studies of cutting edge urban design themes and projects, and explores how such efforts may be evaluated. Invited urban design practitioners critique student work on individual topics. Required for Urban Design certificate students.
D. Frenchman, S. Silberberg

11.335J Cities of Tomorrow
(Same subject as 4.245J)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Research seminar on the future of urban design, to focus on developing a realistic projection of the organization, function, and form of cities, based on an analysis of contemporary trends. Review of historical efforts in the tradition of predicting urban change. Analysis of contemporary urban design projects and proposals. Supplemented by readings and speakers in parallel fields likely to have impact on urban form, including information processing, communications, entertainment.
D. Frenchman

11.337J Urban Design Policy and Action
(Same subject as 4.247J)
Prereq: 11.301J
G (Spring)
2-0-7 H-LEVEL Grad Credit
Seminar on ways that governments influence the quality of urban design. Focuses on the success and failure of methods for achieving urban design objectives through various public policy mechanisms: incentives, standards and regulations, owning and operating, creation and enforcement of legal rights, and information-based strategies.
J. M. Schuster

11.339 Downtown
(Same subject as 11.026J, 21H.234J)
Prereq: —
G (Spring)
2-0-7
See description under subject 21H.234J.
R. M. Fogelson

11.340J Legal Issues in the Development Process
(Same subject as 15.658J)
Prereq: Permission of instructor
G (Spring)
3-0-3 H-LEVEL Grad Credit
Reviews the legal issues that arise in the course of acquiring, managing, and developing real estate. Topics covered include purchase and sale agreements, organization of the ownership entity, financing, contracting, federal income taxation of real estate, fiduciary relationships, leasing, and workouts.
L. Fisher

11.341J International Construction Finance
(Same subject as 1.45J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
Examination of financing methods and structure, project financial evaluation, and financial management in the domestic and international construction industry. Analytical concepts and methodologies from modern finance theory and practice presented in lecture/discussions and applied to case analyses including problems in cash-flow analysis, corporate financial structure, project finance, and foreign exchange exposure. Innovative financial securities, such as options, and methods such as privatization and
11.342J The Impact of Globalization on the Built Environment
(Same subject as 1.463J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
Explores the challenges and risks managers of construction, engineering, and architecture companies face in entering global markets. Includes discussion of innovative approaches to marketing, partnering, risk management, finance, specialized delivery systems, privatization, and appropriate strategies for entering international markets. Half-term subject offered in first half of term.
J. Macomber

11.343J E-Commerce and the Internet in Real Estate and Construction
(Same subject as 1.464J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
D. Wolff

11.344J Innovative Project Delivery in the Public and Private Sectors
(Same subject as 1.472J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
Examines the compatibility of various project delivery methods, consisting of organizations, contracts, and award methods, with certain types of projects and owners. Six methods examined: traditional general contracting; construction management; multiple primes; design-build; turnkey; and build-operate-transfer. Consists of lectures, case studies, guest speakers, and a team project to analyze a case example. Half-term subject offered in second half of term.
C. M. Gordon

11.345J Entrepreneurship in Construction and Real Estate Development
(Same subject as 1.462J)
Prereq: Permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit
Explains role of the entrepreneur in the construction industry using case studies to outline different steps in developing construction enterprises. Emphasis on strategic marketing component in the development of these businesses. Lectures address program, development, and construction management services. Guest lectures from entrepreneurs in their field. Team project identifying an opportunity and developing a strategic marketing/business plan for a company in the design/construct or related industries. Half-term subject offered in second half of term.
J. Macomber

11.346 Housing Markets
Prereq: —
G (Spring)
2-0-4
Explores basics of housing economics, including issues of affordability. Hedonic modeling introduced. Focuses on helping students develop a research topic in this area. Students write a term paper on a housing topic of their choice. Half-term subject offered in first half of term.
L. Fisher

11.347 Topics in Housing Finance
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-4
Focuses on housing finance in the private sector. Designed for students familiar with basic financial concepts. Topics include the optimality of mortgage terms and covenants, the history and economics of the U.S. housing finance system and current products designed for affordable housing development. Students write a term paper on a housing finance topic of their choice. Half-term subject offered in second half of term.
L. Fisher

11.348J Strategic Leadership in Real Estate and Construction
(Same subject as 1.466J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
Examines the fundamental concepts of strategic planning and management in the context of the real estate, design, and construction industry. Basic business relationships among firms in the design and construction value chain. Topics include industry analysis, strategic planning models, information technology strategy, strategy in fragmented industries, negotiation, and macro trends shaping the industry as a whole. Case method of instruction is used, and supplemented by extensive readings. Half-term subject taught in the first half of the term.
J. Macomber

11.349J Real Estate Development I
(Same subject as 4.246J)
Prereq: —
G (Fall, Spring)
6-6-15
Two-term subject delivers the information, skills, and techniques necessary to create the physical products of real estate and manage the process of real estate development. Exposes students to the general skills, techniques and process associated with each of the functional areas involved in real estate development so that they may organize and lead the development process. Assesses the fundamental characteristics of the RED industry, its products, contracts, regulatory and legal context and its markets. Students work in teams to create a development proposal for a particular development opportunity. Enrollment in both terms is mandatory. Enrollment limited; priority given to MSRED students.
T. Ciochetti, L. Fisher

11.360 Community Growth and Land Use Planning
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Seminar and fieldwork on strategies of planning and control for growth and land use, chiefly at the municipal level. Growth and its local consequences; land use planning approaches; implementation tools including innovative zoning and regulatory techniques, physical design, and natural systems integration. Projects arranged with small teams serving municipal clients.
T. S. Szold, E. Ben-Joseph

Environmental Policy and Planning

11.362 Environmental Management Practicum
Prereq: 11.370 or permission of instructor
G (Fall)
3-6-3 H-LEVEL Grad Credit
An external, client-focused subject that addresses real environmental restoration projects. Students deal with pragmatic aspects of environ-
mental planning with a particular emphasis on brownfield redevelopment. Stresses both the use of environmental planning tools in real-time learning, how to interface with regulatory agencies, NGOs and the private sector. A multidisciplinary review board is present to periodically review team progress and comment on the professional side of planning practice. The final deliverable is presented to the client for review and comment.

**Staff**

11.363 Civil Society and the Environment  
**Prereq:** Permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit

Examines the roles civil society actors play in national and international environmental policy and politics. Considers theories pertaining to the development and import of civil society, social movement development and mobilization, and collaboration between state and non-state actors. Case studies of civil society response to specific environmental issues illustrate theoretical issues and assess the impacts that these actors have on domestic, foreign, and international policy and planning outcomes.

*J. Carmin*

11.364 International Environmental Negotiation  
**Prereq:** 11.601, 11.362, 11.255  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
3-0-6 H-LEVEL Grad Credit

Fourth subject in the Environmental Policy and Planning sequence. Seminar looks at problems of managing common resources, difficulties of achieving transboundary pollution control, and the dilemmas of regional harmonization of environmental protection standards (particularly in Europe). At the core of these problems are issues of how best to structure international negotiations. Focuses especially on problems of representation voting, linkage, and enforcement.

*L. E. Susskind*

11.365 Disaster, Vulnerability, and Resilience  
**Prereq:** —  
G (Spring)  
3-0-9

Explores vulnerabilities to natural and technological disasters and ways to promote resilience. Designed both for people interested in the societal dimensions of disaster from a research or policy perspective and for those who may be charged with responsibility for on-the-scene intervention. Topics addressed include social, technological, and environmental vulnerabilities; disaster institutions, agencies and policies; normative and operational issues in preparation, warning, and response; individual and group decision-making under stress.

*J. Carmin*

11.366 Planning, Participation and Consensus Building for Sustainable Development  
**Prereq:** Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit

Examines the political economy of development planning and implementation, with a focus on developing countries in Asia, Africa and Latin America. Assesses the concept of sustainable development and its application in planning processes. Asks when and how stakeholder participation, negotiation and consensus building help or hinder attempts to promote sustainability. Emphasis on integration of theory and practice, using local, sectoral, national and global cases.

*D. Fairman*

11.367 The Law and Politics of Land Use  
**Prereq:** Permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit

Analysis of local and state power to regulate land use and development. Particular emphasis on the evolution of planning and zoning regulations, and the perceived narrowing of the relationship between public improvements requirements and development impact. The ability of regulatory bodies to impose environmental performance standards and limit development activity is explored in relation to recent Supreme Court and State SJC decisions. Development decisions rendered by public agencies are reviewed, critiqued, and discussed.

*J. Stearns*

11.368 Environmental Justice  
**Prereq:** Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit

Explores the foundations of the environmental justice movement, current and emerging issues, and the application of environmental justice analysis to environmental policy and planning. Examines claims made by diverse groups along with the policy and civil society responses that address perceived inequity and injustice. International issues and perspectives also considered.

*J. Carmin*

11.369] Energy Policy for a Sustainable Future  
(Same subject as 17.398)  
**Prereq:** Permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit

Focuses on a wide range of current energy and energy-related environmental policies that foster the development and mass deployment of sustainable energy technologies, fuels, and practices. Primary focus is US-based policies at the state, regional and federal level that impact the electricity, transportation and buildings and facilities sectors. Detailed case studies, diverse readings, and guest lectures by prominent policy makers and practitioners.

*J. D. Raab*

11.370 Brownfields Policy and Practice  
**Prereq:** 11.601 or permission of instructor  
G (Spring)  
4-0-8 H-LEVEL Grad Credit

There are several hundred thousand brownfield sites across the country. The large number of sites, combined with the fact that a majority of these properties are located in urban and historically underserved communities, dictate that redevelopment of these sites stands to be a common challenge to urban planners for the foreseeable future. Students develop a ground-ed understanding of the brownfield lifecycle: how and why they were created, their potential role in community revitalization, the role of community-based organizations in spurring their redevelopment, and the general processes governing their redevelopment. Using case studies, field projects, and guest speakers from the public, private and non-profit sectors, students develop and hone skills to effectively address the problems posed by these inactive sites.

*J. Hamilton*

11.371] Sustainable Energy  
(Same subject as 1.818J, 2.65J, 10.391J, 22.811J, ESD.166J)  
**Prereq:** Permission of instructor  
G (Spring)  
3-1-8 H-LEVEL Grad Credit

See description under subject 10.391J.

*M. W. Golay, J. W. Tester, J. P. Freidberg*

11.372 Environmental Planning Methods Modules  
**Prereq:** 11.601  
G (Fall, IAP, Spring)  
Units arranged

Five methods modules are offered covering a range of analytical tools and techniques used by practicing planners. Modules cover environmen-
tal impact assessment techniques, Brownfields assessment techniques, environmental and health risk assessment techniques, cost-benefit analysis techniques, and legal analysis litigation strategies. Modules are typically four weeks long.

EPP Staff

11.373 Science, Politics and Environmental Policy
Prereq: —
G (Fall)
3-0-9

Examines the role of science in the US environmental policy making process. Investigates the methods by which scientists learn about the natural world; the treatment of science by experts, advocates, the media, and the public; and the way science is used in legislative, administrative and judicial decision making. Concludes by taking up novel approaches to integrating science into politics, such as employing stakeholder collaboration, local knowledge, adaptive management, and the precautionary principle.

J. Layz

11.374 The Politics of Ecosystem Management
Prereq: —
G (Spring)
3-0-9

Investigates efforts to restore and maintain the health of ecosystems, including forest, watershed, and marine ecosystems. Traces the evolution of the ecosystem-based approach and examines how it has been implemented during the past two decades. Concludes by looking at prominent experiments in ecosystem-based management to see whether and how such initiatives provide genuine environmental protection.

J. Layz

11.375 Role of Science and Scientists in Collaborative Approaches to Environmental Policymaking
Prereq: 11.601, 11.373
G (Spring)
2-0-7

Explores the evolving role of scientists and research in contemporary society. Examines joint fact finding within the context of adaptive management and ecosystem-based management. Challenges and obstacles to collaborative approaches for deciding environmental policy and natural resource policy and the institutional changes necessary within federal agencies to bridge the gap between science, policy, and management to achieve more durable policies and effective management decisions are discussed and reviewed with scientists, policymakers, and managers. Senior-level federal policymakers participate.

H. Karl

Housing, Community, and Economic Development

11.401 Introduction to Housing and Community Development
Prereq: —
G (Fall)
3-0-9

Explores how public policy and private markets affect housing, economic development, and the local economy; provides an overview of techniques and specified programs policies and strategies that are (and have been) directed at neighborhood development; gives students an opportunity to reflect on their personal sense of the housing and community development process; emphasizes the institutional context within which public and private actions are undertaken.

J. P. Thompson

11.402 Urban Politics: Race and Political Change
Prereq: —
G (Fall)
3-0-9

Examines the place of US cities in political theory and practice. Particular attention given to contemporary issues of racial polarization, demographic change, poverty, sprawl, and globalization. Specific cities, such as New York and Los Angeles are a focus for discussion.

J. P. Thompson

11.403 Springfield Community Studio
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

A practicum subject that focuses on the physical, programmatic, and social renewal of the North End community in Springfield, MA, by combining classroom work with an applied class project. Builds on a long-term commitment to partnership with the North End community in Springfield, a predominantly Puerto Rican community with strong social networks, a high level of community involvement, and all the attendant issues of urban poverty. Each year the practicum works on a specific issue identified by the community. Past topics have included economic planning, land use planning, and environmental mapping.

C. McDowell, Staff

11.410J Cities and Regions: Urban Economics and Public Policy
(Same subject as 12.83J, 14.573J, ESD.191J)
Prereq: 14.03 or 14.04
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 14.573J.

W. Wheaton

11.414J Labor and Politics
(Same subject as 17.188J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9

See description under subject 17.188J.

R. Locke

11.422 Downtown Management Organizations
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Focuses on the origins, functions, and implications of downtown management organizations (DMOs) such as business improvement districts in a variety of national contexts including the US, Canada, South Africa, and the UK. Critically examines how a range of urban theories provide a rationale for the establishment and design of DMOs; the evolution and transnational transfer of DMO policy; and the spatial and political externalities associated with the local proliferation of DMOs. Particular emphasis given to the role of DMOs in securing public space.

L. Hoyt

11.423 Information, Asset-building, and the Immigrant City
Prereq: Permission of instructor
G (Fall)
4-6-2 H-LEVEL Grad Credit

Practicum follows a participatory action research model whereby students work hand-in-hand with not-for-profit housing developers and municipal planners in the city of Lawrence, MA, to craft a strategic affordable housing plan. Known as the ”Immigrant City,” Lawrence is part of a multiyear HUD-funded community outreach program intended to empower Latina women and youth by building individual and community assets through the use of spatial and other information technologies. Emphasizes reflection as a tool for investigating the nexus between planning practice and theory as well as issues of race/ethnicity, civic engagement, and the construction of urban narratives.

L. Hoyt, L. Keyes
11.424 Democracy, Inequality, and the City
Prereq: —
G (Fall)
3-0-9
Cities and the urban experience serve as a format to rethink democracy and the urban challenges of equity and social justice. Explores citizenship, the public sphere, avenues for democratic participation, struggles for social and political justice and how they inform life in cities. Readings include classic theoretical and historical works; Harvey, Lefebvre, de Toqueville, Castells, Sennett, Tilly, Bellah, Katzenelson, Ryan plus empirical studies of social and spatial patterns of injustice in cities here and abroad. Assignments and discussion build on normative aims of empowering citizens and state actors (from planners to politicians) to make cities more just, equitable, and democratic.
D. E. Davis

11.425 Urban Labor Markets
Prereq: 11.203
G (Spring)
3-0-9
Focuses on the recent evolution of central city labor markets. Topics include the changing occupational structure of central cities; the occupation/population skills mismatch; education, wages, and urban schooling; the spatial mismatch and mobility strategies; the position of minority groups in central city labor markets; the interaction between welfare programs and labor markets; the potential role of job training.
Staff

11.426 Cities and Globalization
Prereq: —
G (Fall)
3-0-9
Cities examined in the context of globalization. Subject examines changing nature and character of cities as produced by increased transnational migration flows, accelerated international trade, diminished institutional capacities of states (both local and national), and new forms of urban employment investment, and economic restructuring in an age of globalization. Among themes discussed are globalization’s impact on the economic health, social and ethnic composition, political dynamics, and urban policy priorities of cities. Readings focus mainly on the American urban experience, including Boston, and Detroit, with additional emphasis on “global cities” (New York City, Los Angeles, London, Tokyo, Mexico City, Sao Paolo), and how transformations in these locales produce increasing urban inequality both nationally and worldwide. Consult Department Headquarters

11.427 Urban Labor Markets and Employment Policy
(Same subject as 15.677J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 15.677J.
P. Osterman

11.430J Leadership in the Real Estate Industry
(Same subject as 15.941J)
Prereq: 11.431J, 15.401, or 15.414
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject 15.941J.
G. Schuck

11.431J Real Estate Finance and Investment
(Same subject as 15.426J)
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Concepts and techniques for analyzing financial decisions in property development and investment. Topics: leasing and property income streams, pro forma analysis, equity valuation, tax analysis, options, risk, and the financial structuring of real property ownership.
Staff

11.432J Real Estate Capital Markets
(Same subject as 15.427J)
Prereq: 11.431J; 15.401, 15.402, or 15.407
G (Spring)
2-0-4 H-LEVEL Grad Credit
D. Geltner

11.433J Real Estate Economics
(Same subject as 15.021J)
Prereq: 14.01, 15.010, or 15.011
G (Fall)
4-0-8 H-LEVEL Grad Credit
Focuses on developing an understanding of the factors that shape and influence markets for real property. Includes demographic analysis, patterns of regional growth, construction cycles, urban location theory, and modeling techniques for predicting demand.
W. C. Wheaton

11.434J Advanced Topics in Real Estate Finance
(Same subject as 15.428J)
Prereq: —
G (Spring)
2-0-4
Primarily for students intending to write their MSRED thesis in an area of real estate finance. Focuses on such topics as: portfolio analysis, equilibrium asset price models, real estate investment performance measurement, real options, real estate securitization, and international real estate investment. Designed to allow students to pursue an area of individual interest by means of a term paper project. Half term subject. Offered second half of term.
D. Geltner

11.437 Financing Economic Development
Prereq: —
G (Fall)
3-0-9
Focuses on financing tools and program models to support local economic development. Includes an overview of private capital markets and financing sources to understand capital market imperfections that constrain economic development; business accounting; financial statement analysis; federal economic development programs; and public finance tools. Policies and program models covered include revolving loan funds, guarantee programs, venture capital funds, bank holding companies, community development loan funds and credit unions, micro enterprise funds, and the Community Reinvestment Act.
K. F. Seidman

11.438 Economic Development Planning
Prereq: 11.203, 11.220
G (Spring)
3-0-9 H-LEVEL Grad Credit
Focuses on the policy tools and planning techniques used to formulate and implement local economic development strategies. Includes an overview of economic development theory, discussion of major policy areas and practices employed to influence local economic development, a review of analytic tools to assess local economies and how to formulate strategy. Coursework includes formulation of a local economic development strategy for a client.
K. F. Seidman
11.439 Revitalizing Urban Main Streets
Prereq: 11.401, 11.301J, or 11.328J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-11 H-LEVEL Grad Credit

Workshop explores the integration of economic development and physical planning interventions to revitalize urban commercial districts. Covers an overview of the causes of urban business district decline, revitalization challenges, and the strategies to address them; the planning tools used to understand and assess urban Main Streets from both physical design and economic development perspectives; and the policies, interventions, and investments used to foster urban commercial revitalization. Students apply the theories, tools and interventions discussed in class to preparing a formal neighborhood commercial revitalization plan for a client business district.

K. F. Seidman, S. Silberberg

11.441 Community Workshop I
Prereq: Permission of instructor
G (Fall)
3-2-4

11.442 Community Building Workshop II
Prereq: Permission of instructor
G (Spring)
3-2-4

Community workshops offered by The Center for Reflective Community Practice (CRCP). Subject centers on the social, economic, political, and technological complexities inherent in supporting the equitable development of poor and minority communities. The seminar/workshop format includes collaborative projects that include community residents, professionals and faculty. Each year the subject focuses on a particular issues facing one of the current CRCP community partnerships.

C. McDowell, Staff

11.463J Structuring Low-Income Housing Projects in Developing Countries
(Same subject as 4.236J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 4.236J.

R. Goethert

11.464 The Informal Sector and the Household Economy
Prereq: 11.701
G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines interrelationships among low-income households, small-scale, income-generating activities, and the urban economy in developing countries. Theories of employment and an analysis of “bazaar economies” looked at. Reviews policy options for enhancing the informal sector’s contribution to development. The role of women and the possibilities of nonmonetary activities explored.

B. Sanyal

11.465J Special Interest Group in Urban Settlements: SIGUS Workshops
(Same subject as 4.23J)
Prereq: Permission of instructor
G (IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

See description under subject 4.23J.

R. Goethert

11.466J Sustainability, Trade, and the Environment
(Same subject as 1.813J, 15.657J, ESD.137J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject ESD.137J.

N. A. Ashford

11.467J Property Rights under Transition
(Same subject as 4.257J, 17.550J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines the theories and policy debates over who can own real property, how to communicate and enforce property rights, and the range of liberties that they confer. Explores alternative economic, political, and sociological perspectives of property rights and their policy and planning implications.

A. M. Kim

11.468J SIGUS Workshop: Learning from Communities
(Same subject as 4.230J)
Prereq: Permission of instructor
G (IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

See description under subject 4.230J.

R. Goethert

11.469 Urban Sociology in Theory and Practice
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-10 H-LEVEL Grad Credit

Introduction to core writings in urban sociology. Topics include: the changing nature of community, social inequality, political power, socio-spatial change, technological change, and the relationship between the built environment and human behavior. Examine key theoretical paradigms that have constituted the field since its founding, assess how and why they have changed over time, and discuss the implications of these paradigmatic shifts for urban scholarship, social policy and the planning practice. Explore the nature and changing character of the city and the urban experience, including the larger social, political, and economic dynamics of urban change, to enhance appreciation of contemporary, comparative, and historical context in which urban planning skills and sensibilities have been developed and could be applied.

D. E. Davis

11.470 The Politics of Development Policy
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines the political forces and conditions that affect urban, regional, and national development policymaking. Key protagonists include political parties, state actors, social movements, NGOs...
11.471 Political Economy of Development Projects: Targeting the Poor
Prereq: 11.701 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Covers conditions under which public-sector policies, programs, and projects succeed in enhancing the economic activities of poorer groups and micro-regions in developing countries. Topics include local economic development; small enterprises; various forms of collective action; labor and worker associations; nongovernment organizations. Links these to literature on poverty, economic development, and reform of government, and to types of projects, tasks, and environments that are conducive to equitable outcomes.

J. Tendler

11.472 D-Lab: Development
(Subject meets with 11.025J, SP.721J)
Prereq: Permission of instructor
G (Fall)
3-2-7

Introduces students to classical theories of economic, social, and political modernizations focusing on the role of technological change in the multifaceted process of development of newly industrializing nations. Drawing on theories as well as case studies and hands-on exercises, the course introduces students to the potential as well as deficiencies of the dominant models of technological innovation focused particularly on the needs and capabilities of poor households. Students are encouraged to develop specific plans for innovative technical solutions and test out such plans during IAP through site visits to poor communities in Asia, Africa, and Latin America where they work with host institutions in fostering technological change and institution building.

A. B. Smith, B. Sanyal

11.479J Water and Sanitation Infrastructure in Developing Countries
(Open subject as 1.851J)
Prereq: —
G (Spring)
Units arranged

Principles of infrastructure planning in developing countries, with a focus on appropriate and sustainable technologies for water and sanitation. Incorporates technical, socio-cultural, public health, and economic factors into the planning and design of water and sanitation systems. Upon completion, students are able to plan simple, yet reliable, water supply and sanitation systems for developing countries that are compatible with local customs and available human and material resources. Graduate and upper division students from any department who are interested in international development at the grassroots level are encouraged to participate in this interdisciplinary subject.

Consult Department Headquarters

A. M. Kim

11.481J Analyzing and Accounting for Regional Economic Change
(Same subject as 1.284J, ESD.192J)
Prereq: 14.03, 14.04
G (Spring)
3-0-9 H-LEVEL Grad Credit

Surveys theories of regional growth, factor mobility, clustering, industrial restructuring, learning regions, and global supply chains from a political-economy perspective. Examines critiques accounting frameworks including accounting for the underground economy, multipliers, linkages, and supply chains used to assess employment and environmental impacts, infrastructure investments. Assesses price indices, industrial location and employment measures, and shift-share analyses. Discussions of US and foreign applications.

K. R. Polenske

11.482J Regional Socioeconomic Impact Analyses and Modeling
(Same subject as 1.285J, ESD.193J)
Prereq: 11.481J or permission of instructor
G (Fall)
2-1-9 H-LEVEL Grad Credit

Surveys regional economic theories and models and provides students with experience in using alternative economic impact assessment models on microcomputers. Problem sets are oriented around infrastructure, housing, energy, and environmental issues. Students work with a client generally in Boston and make a presentation to the client. Emphasis on written and oral presentation skills.

K. R. Polenske

11.484 Project Evaluation in Developing Countries
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Critical analysis of these tools and their role in the political economy of international development. Topics include alternative planning strategies for conditions of uncertainty, organizations and project cycle management, the political environment and the interactions of clients and advisers, engineers, planners, policy analysts, and other professionals.

11.485 Planning in Transition Economies
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Surveys the recent historic transformation of former centrally planned economies in Europe and Asia. Topics include the reformulation of property rights and institutional development, the emergence of the private sector, the changing role of the state, the spatial transformation of cities, and the redistribution of wealth.

A. M. Kim

11.486J Economic Institutions and Growth Policy Analysis
(Same subject as 14.778J, 17.184J)
Prereq: 11.203
G (Spring)
3-0-6 H-LEVEL Grad Credit

Considers how institutions have been incorporated theoretically into explorations of growth and development. Four sets of institutions are examined in detail: the corporate sector, to study how ownership, strategy, and structure affect growth-related policies; financial institutions, to analyze how they condition savings and investment; labor market institutions, to investigate their impact on the determination of wage and production-related productivity; and the institutions associated with technology, such as universities, research laboratories, and corporate training centers, to consider how skill formulation is accomplished.

A. Amsden, M. Piore

11.487J Urban Public Finance in Developing Countries
Prereq: 11.701, 11.426, or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Explores the question of how to pay for urban public services in developing countries. Use of cases, implicit ethical issues, and diverse public financing arrangements and institutional contexts to appreciate the difficult choices the public sector faces in developing countries. The goal is to gain facility in public finance analysis, familiarity with a variety of sources of
public finance and their tradeoffs, and a general theoretical framework with which to approach real urban financing problems in developing countries.

A. M. Kim

11.488 Cities and Public Security
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines how public security shapes, and is shaped by, the spatial character, political dynamics, and social experience of cities. A special concern is the “privatization” of public security and policing, and what it means for equality, rule of law, crime, violence, access to public space, community power, and quality of life in cities here and abroad. Subject has both theoretical and practical aims, and readings range from general accounts of the logic of social control to institutional analyses of police to case studies of police-community relations to city profiles in which the privatization of police brings greater physical and social segregation.

D. Davis

11.489 The Growth and Spatial Structure of Cities
Prereq: —
G (Spring)
3-0-9

Examines the economic, political, social, and spatial dynamics of urban growth and decline in cities and their key component areas (downtown, suburbs, etc.). Topics include impacts of industrialization, technology, politics, and social practices on cities. Examines the role of public and private sector activities, ranging from zoning and subsidies to infrastructure development and real estate investment, affecting urban growth and decline. Readings are both theoretical and empirical, with considerable thought paid to comparative and historical differences.

D. Davis

11.491J Economic Development and Policy Analysis I
(Same subject as 17.176J)
Prereq: 11.701
G (Fall)
3-0-9 H-LEVEL Grad Credit

Analyzes the theoretical and historical reasons why governments in latecomer countries have intervened with a wide array of policies to foster industrial development at various turning points: the initiation of industrial activity; the diversification of the industrial base; the restructuring of major industrial institutions; and the entry into high-technology sectors.

A. Amsden

11.492J Economic Development and Policy Analysis, Part II
(Same subject as 17.190J)
Prereq: 11.491J
G (Spring)
3-0-9 H-LEVEL Grad Credit

Analyzes economic development in “the remainder,” or in countries that largely failed to enter the orbit of modern world industry since the end of World War II. Looks at the reasons for falling behind in terms of history, geography/global transactions, institutions (including business enterprises), policies and knowledge-based assets. Explores potential policies for accelerating the process of industrial transformation and the control mechanism necessary to improve government planning.

A. Amsden

11.493 Legal Aspects of Property and Land Use
Prereq: —
G (Fall)
3-0-9

Examines the legal and institutional arrangements for the establishment, transfer, and control over property under American and selected comparative systems including India and South Africa. Emphasizes efficient resource use, institutional, entitlement, and relational approaches to property, distributional and other social aspects, and the relationship between property, culture, and democracy.

B. Rajagopal

11.494 Law and Politics of Local Governance
Prereq: —
G (Spring)
3-0-9

Offers an introduction to the legal and institutional issues that arise in local and city governance. Focuses on the way institutional arrangements and legal concepts influence how power is distributed, how it is exercised and by whom, and explores alternative arrangements. Principal emphasis on American local government law, with forays into comparative legal regulation.

B. Rajagopal

11.495 Governance and Law in Developing Countries
Prereq: Permission of instructor
G (Spring)
2-0-10 H-LEVEL Grad Credit

Examines the multiple dimensions of governance in international development with a focus on the role of legal norms and institutions. Critically examines the changes in the distribution of authority, political and legal, as a result of economic globalization. Explores the relationship between local and global governance and the idea of multilevel governance. Topics include the role and the reform of the State, the role of civil society and markets, global governance, the role of the judiciary and legal culture in development and tools for measuring governance performance.

B. Rajagopal

11.496 Law, Social Movements, and Public Policy: Comparative and International Experience
(Subject meets with 11.166)
Prereq: Permission of instructor
G (Fall)
3-0-9

Examines the role that courts and social movements play in shaping public policy, at the global level and within selected countries. Primary focus on law, courts and grassroots activism on processes and outcomes of public policy, in current areas like gender, race, trade, environment, and human rights. Introduction to theoretical frameworks that help critically link law and society. Research paper required for graduate students.

B. Rajagopal

11.497 Human Rights in Theory and Practice
(Subject meets with 11.164J, 17.391J)
Prereq: —
G (Spring)
3-0-9

Provides a rigorous and critical introduction to the foundation, structure and operation of the international human rights movement. Focus on current debates in human rights including democracy promotion, economic and social rights in development and globalization, gender and race discrimination, religion, use of military force and humanitarian intervention, terrorism, and ethical issues in science and technology. Meets with 11.164, but graduate students are expected to write a research paper.

B. Rajagopal
11.520 A Workshop on Geographic Information Systems
Prereq: 11.204 or permission of instructor
G (Fall)
3-6-3 H-LEVEL Grad Credit
Credit cannot also be received for 11.188, 11.208
An introduction to geographic information systems (GIS) as applied to urban and regional planning, community development, and local government. Emphasis on learning GIS technology and spatial analysis techniques through extensive hands-on exercises using real-world data sets such as the US census of population and housing. Includes a small project on an urban planning problem involving the selection of appropriate methods, the use of primary and secondary data, computer-based modeling, and spatial analysis. This full-term subject includes all topics in the IAP module 11.208.
J. Ferreira

11.521 Spatial Database Management and Advanced Geographic Information Systems
Prereq: 11.220 and 11.520 or permission of instructor
G (Spring)
3-3-6 H-LEVEL Grad Credit
Credit cannot also be received for 11.523, 11.524
Extends the computing and geographic information systems (GIS) skills developed in 11.520 to include spatial data management in client/server environments and advanced GIS techniques. First half covers the content of 11.523, introducing database management concepts, SQL (Structured Query Language), and enterprise-class database management software. Second half explores advanced features and the customization features of GIS software that perform analyses for decision support that go beyond basic thematic mapping. Includes the half-semester GIS project of 11.524 that studies a real-world planning issue.
J. Ferreira

11.522 Research Seminar on Urban Information Systems
Prereq: 11.204 or 11.521, and 11.520 or 11.525
G (Fall)
2-4-6 H-LEVEL Grad Credit
Can be repeated for credit
Advanced research seminar enhances computer and analytic skills developed in other subjects in this sequence. Students present a structured discussion of journal articles representative of their current research interests involving urban information systems and complete a short research project. Suggested research projects include topics related to ongoing UIS Group research.
J. Ferreira

11.523 Fundamentals of Spatial Database Management
Prereq: 11.204 or permission of instructor
G (Spring)
2-2-2 H-LEVEL Grad Credit
Credit cannot also be received for 11.521, 11.524
The fundamentals of database management systems as applied to spatial analysis. Includes extensive hands-on exercises using real-world planning data. Introduces database management concepts, SQL (Structured Query Language), and enterprise-class database software. Same content as first half of 11.521.
J. Ferreira

11.524 Advanced Geographic Information System Project
Prereq: 11.523 or permission of instructor
G (Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Credit cannot also be received for 11.521, 11.523
Learning and utilizing advanced geographic information system techniques in studio/lab setting with real-world client problem and complex digital spatial data infrastructure. Projects typically use the client and infrastructure setting for 11.521. Credit cannot also be received for 11.521 in the same term.
J. Ferreira

11.525 Emerging Technologies for Planners
Prereq: 11.204 or permission of instructor
G (Spring)
3-2-7 H-LEVEL Grad Credit
Students are familiarized with the changing technologies available for manipulating, organizing, and presenting visually-oriented electronic information for the description of urban environmental phenomena. Students are exposed to cases where these technologies have been used, or are in use, by planning-related agencies. Impacts of these technologies upon public debate and decision making are studied. Specific attention is paid to multimedia and communication technologies and how these have the ability to change the way people plan.
Staff

11.526j Comparative Land Use and Transportation Planning
(Same subject as 1.251j)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Focuses on the integration of land use and transportation planning, drawing from cases in both industrialized and developing countries. Reviews underlying theories, analytical techniques, and the empirical evidence of the land-use-transportation relationship at the metropolitan, intra-metropolitan, and micro-scales. Also covers the various ways of measuring urban structure, form, and the “built environment.” Develops students’ skills to assess relevant policies, interventions and impacts.
C. Zegras

11.528j Urban Spatial Structure, Transportation, and Telecommunications I
(Same subject as ESD.229j)
Prereq: 11.204 or permission of instructor
G (Spring)
3-1-2 H-LEVEL Grad Credit
Discusses the meanings of urban space and the role of transportation planning in a contemporary metropolitan context. Topics include formation and evolution of land use patterns; job accessibility of low-skilled workers; strategies for improving accessibility; integration of transportation planning with housing, social service, and job placement; and impact of advanced communication and information technologies on urban space. Applies spatial analysis, GIS, and transportation planning methods to a case study of Boston.
Staff

11.529 Urban Spatial Structure, Transportation, and Telecommunications II
Prereq: 11.528 or permission of instructor
G (Spring)
3-0-3 H-LEVEL Grad Credit
Extends the analytical frameworks developed in 11.528j and applies them to the examination of urban land use, transportation, and telecommunications-related problems. Sheds light on ongoing policy debates by analyzing empirical data using GIS and spatial models. Students undertake a short research project individually or participate in a group project.
Staff
11.530 Community and Technology
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
2-0-10 H-LEVEL Grad Credit

Critical overview of recent studies on the social implications of new media on community, networks and society. Topics include personal computing, Internet use, mobile phones, virtual community, blogs, etc. Critical evaluation of empirical studies, use of social network analysis, and research projects address sociological research questions.
K. Hampton

11.540J Urban Transportation Planning
(Same subject as 1.252J, ESD.225J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

History, policy, and politics of urban transportation. The role of the federal government and the “highway revolt.” Public transit in the auto era. Analytic tools for transportation planning and policy analysis. The contribution of transportation to air pollution and climate change. Land use and transportation interactions. Bicycles, pedestrians, and traffic calming. Examples from the Boston area.
F. Salvucci, M. Murga

11.541J Public Transportation Systems
(Same subject as 1.258J, ESD.226J)
Prereq: 1.201J or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 1.258J.
N. H. M. Wilson

11.543J Transportation Policy and Environmental Limits
(Same subject as 1.253J, ESD.222J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 1.253J.
J. Coughlin, F. Salvucci

11.544J Transportation Systems Analysis
(Same subject as 1.200J, ESD.211J)
Prereq: 1.010 and permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit

See description under subject 1.200J.
C. Barnhart, A. R. Odori

11.545J Introduction to Transportation Systems
(Same subject as 1.201J, ESD.210J)
Prereq: Permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit

See description under subject 1.201J.
J. Sussman, N. H. M. Wilson

11.601 Introduction to Environmental Policy and Planning
Prereq: —
G (Fall)
3-0-9

Required introductory subject for graduate students pursuing environmental policy and planning as their specialization in the MCP Program. Also open to all DUSP/TPP students interested in the environmental policy debate as well as the range of environmental planning tools and techniques. Class is taught comparatively, with constant reference to examples from around the world. Consists of three parts: The Environmental Policy Debates, Environmental Planning Techniques and Strategies, and Synthesis and Preparation for Practice. The first part revolves around debate-style presentations in which student teams test contrary arguments drawing on the relevant philosophical literature. The second part provides an overview of techniques and strategies for environmental management and planning. The third part introduces students to EPP faculty work and helps students formulate a plan for the remainder of their graduate studies.
L. Susskind

11.630J Environmental Law, Policy, and Economics: Pollution Prevention and Control
(Same subject as 1.811J, ESD.133J)
Prereq: Permission of instructor for undergraduates
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 1.811J.
N. A. Ashford, C. C. Caldart

11.631J Regulation of Chemicals, Radiation, and Biotechnology
(Same subject as 1.812J, ESD.134J)
(Subject meets with 1.802J, 11.022J)
Prereq: Permission of instructor for undergraduates
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 1.812J.
N. A. Ashford, C. C. Caldart

11.701 Introduction to Planning and Institutional Processes in Developing Countries
Prereq: —
G (Fall)
3-0-9

Interaction between planners and institutions at both national and local levels. Overview of theories of state, organizational arrangements, implementation mechanisms, and planning styles. Case studies of planning: decentralization, provision of low-cost housing, and new-town development. Analyzes various roles planners play in different institutional contexts. Professional ethics and values amidst conflicting demands. Restricted to first-year MCP and SPURS students.
Staff

Tutorials, Research, and Field Work Subjects

11.800 Doctoral Research Seminar
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Required subject for all entering PhD students. Dual focus is on formulating researchable questions (to help students write their first-year papers) and understanding how research knowledge comes to be influential in the world or not influential. Explores ways to make research knowledge more accessible, credible, and useful in the realm of public policy and practice. Addresses the politics of the policymaking process, the power of framing and agenda-setting, how knowledge diffuses along knowledge and influence networks, and how varied types of knowledge influence decision-making and action.
F. Levy, X. Briggs, M. Rein

11.900 Doctoral Proseminars
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit

Can be repeated for credit

Designed primarily for advanced doctoral candidates. A selection of proseminars is offered each year for groups of students affiliated with the various research clusters in the department.
F. Levy
11.901 Research Seminar: Topics in Urban Studies and Planning  
Prereq: Permission of instructor  
G (Fall)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
11.902 Research Seminar: Topics in Urban Studies and Planning  
Prereq: Permission of instructor  
G (Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Small group study of advanced subjects under staff supervision. For graduate students wishing to pursue further study in advanced areas of urban studies and city and regional planning not covered in regular subjects of instruction.  
L. Vale  

11.911, 11.912 Supervised Readings in Urban Studies  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Reading and discussion of special topics in urban studies and planning.  
Staff  

11.913 Special Topics in Urban Studies and Planning  
Prereq: —  
G (Fall)  
1-0-2 [P/D/F]  
Special topics in Urban Studies and Planning.  
Restricted to first-year MCP students.  
R. Ryznar  

11.914 Special Topics in Urban Studies and Planning  
Prereq: —  
G (Spring)  
2-0-1  
Special topics in Urban Studies and Planning.  
Restricted to first-year MCP students.  
X. Briggs  

11.921, 11.922 Special Seminars in Real Estate Development  
Prereq: —  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Opportunity for group study on current topics related to real estate not otherwise included in the curriculum.  
Consult W. Wheaton  

11.941–11.955 Special Studies in Urban Studies and Planning  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Small group study of advanced subjects under staff supervision. For graduate students wishing to pursue further study in advanced areas of urban studies and city and regional planning not covered in regular subjects of instruction.  
L. Vale  

11.956–11.959 IAP Special Studies in Urban Studies and Planning  
Prereq: Permission of instructor  
G (IAP)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Special subjects offered during IAP. 11.958 and 11.959 are taught P/D/F.  
L. Vale  

11.960, 11.961 IAP Special Studies in Real Estate  
Prereq: —  
G (IAP)  
Units arranged [P/D/F]  
Can be repeated for credit  
Special subjects offered during IAP.  
W. Wheaton  

11.962 Urban Fieldwork and Internships  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Practical application of planning techniques to towns, cities, and regions, including problems of replanning, redevelopment, and renewal of existing communities. Includes internships, under staff supervision, in municipal and state agencies and departments.  
L. Vale  

11.963–11.969 Special Studies in Urban Studies and Planning  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Small group study of advanced subjects under staff supervision. For graduate students wishing to pursue further study in advanced areas of urban studies and city and regional planning not covered in regular subjects of instruction.  
L. Vale  

11.981 Graduate Tutorial  
Prereq: —  
G (Fall)  
Units arranged  
Can be repeated for credit  
11.982 Graduate Tutorial  
Prereq: —  
G (Spring)  
Units arranged  
Can be repeated for credit  
Planned programs of individual instruction.  
Students and faculty members must make arrangements prior to the beginning of the term.  
L. Vale  

11.983 SPURS Seminar  
Prereq: —  
G (Fall, Spring)  
Units arranged [P/D/F]  
Provides skills to enable SPURS fellows to grasp complex issues of urban and regional change.  
Aims to facilitate professional interactions with scholars, policy makers, and practitioners in the field. MIT faculty and outside specialists share expertise on issues related to globalization, urban development, infrastructure, and public policy. Fellows present their professional interests and research, and hone practical and professional skills. Fellows prepare a research paper that addresses an important issue in their practice and conducts an examination of that issue. Final research paper is presented to the larger MIT community. SPURS fellows only.  
Staff  

11.985 Summer Thesis Writing  
Prereq: —  
G (Summer)  
Units arranged  
Designed to be used specifically for thesis writing and research during the summer.  
L. Vale  

11.986 Graduate Thesis  
Prereq: —  
G (Fall, IAP, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Program of research and writing of thesis; to be arranged by the student with supervising committee.  
Staff
UNDERGRADUATE SUBJECTS

12.UR Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

12.URG Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Undergraduate research opportunities in Earth,
EAPS Faculty

12.ThU Undergraduate Thesis
Prereq: 12.TIP
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Program of research leading to the writing of
a thesis; to be arranged by the student and an
appropriate MIT faculty member.
EAPS Faculty

Core and General Science Subjects

12.000 Solving Complex Problems
Prereq: —
U (Fall)
1-2-6

Provides an opportunity for entering freshmen
to gain first-hand experience in integrating
the work of small teams to develop effective
solutions to complex problems in Earth system
science and engineering. Each year’s class
explores a different problem in detail through
the study of complementary case histories and
the development of creative solution strategies.
Includes exercises in website development,
written and oral communication, and team
building. Subject required for students in the
Terrascope freshman program, but participation
in Terrascope is not required of all 12.000 stu-
dents. Students who pass 12.000 and are in the
Terrascope program are eligible to participate
in the Terrascope field trip the following spring.
Enrollment limited to freshman.
S. A. Bowring, R. Bras

12.001 Introduction to Geology
Prereq: —
U (Spring)
3-4-5 REST

Major rock-forming minerals, rock-forming pro-
cesses, and rock types. Geologic structures and
relationships observable in the field. Geologic
time scale, dating of rocks by fossil and isotopic
methods. Sediment movement and landform
development by moving water, wind, and ice.
Crustal processes and evolution in terms of
global plate tectonics. Geologic history of the
continents, with emphasis on North America.
Laboratories on minerals, rocks, fossils, and
mapping. Two nonrequired one-day field trips.
Staff

12.002 Physics and Chemistry of the Terrestrial
Planets
Prereq: 8.02, 18.02
U (Fall)
3-1-8 REST

Study of the structure, composition, and physi-
cal processes governing the terrestrial planets,
including their formation and basic orbital
properties. Topics include plate tectonics,
earthquakes, seismic waves, rheology, impact
cratering, gravity and magnetic fields, heat flux,
thermal structure, mantle convection, deep
interiors, planetary magnetism, and core dynam-
ics. Suitable for majors and non-majors seeking
general background in geophysics and planetary
structure.
L. H. Royden, B. Weiss

12.003 Physics of the Atmosphere and Ocean
Prereq: 18.02, 8.01
U (Fall)
3-1-8 REST

The laws of classical mechanics and thermody-
namics are used to explore how the properties
of fluids on a rotating Earth manifest themselves in,
and help shape, the global patterns of atmos-
pheric winds, ocean currents, and the climate of
the Earth. Theoretical discussion focuses on the
physical processes involved. Underlying mecha-
nisms are illustrated through laboratory dem-
 Onstrations, using a rotating table, and through
analysis of atmospheric and oceanic data.
J. Marshall

12.005 Applications of Continuum Mechanics to
Earth, Atmospheric, and Planetary Sciences
Prereq: 8.02, 18.02, 18.03
U (Spring)
3-0-9

Practical applications of the continuum concept
for deformation of solids and fluids, emphasizing
force balance. Stress tensor, infinitesimal
and finite strain, and rotation tensors devel-
oped. Constitutive relations applicable to
geological materials, including elastic, viscous,
brittle, and plastic deformation. Solutions to
classical problems in geodynamics.
B. H. Hager
12.006J Nonlinear Dynamics I: Chaos
(Same subject as 2.050J, 18.353J)
Prereq: 18.03, 8.02
U (Fall)
3-0-9


12.007 Geobiology
Prereq: —
U (Spring)
3-0-9

The interactive Earth system: biology in geologic, environmental and climate change throughout Earth history. Since life began it has continually shaped and reshaped the atmosphere, hydrosphere, cryosphere, and the solid earth. Introduces the concept of “life as a geological agent” and examines the interaction between biology and the earth system during the roughly 4 billion years since life first appeared. Topics include the origin of the solar system and the early Earth atmosphere; the origin and evolution of life; and its influence on climate up through and including the modern age and the problem of global warming; the global carbon cycle; and astrobiology. R. Summons

12.008 Classical Mechanics: A Computational Approach
(Subject meets with 6.946J, 8.351J, 12.620J)
Prereq: 8.01, 18.03
U (Fall)
3-3-6

See description under subject 12.620J. J. Wisdom, G. J. Sussman

12.010 Computational Methods of Scientific Programming
Prereq: 18.01, 18.02, 8.01
U (Fall)
4-0-8

Introduces programming languages and techniques used by physical scientists: FORTRAN, C, C++, Matlab, and Mathematica. Emphasis on program design, algorithm development and verification, and comparative advantages and disadvantages of different languages. Students first learn the basic usage of each language, common types of problems encountered, and techniques for solving a variety of problems encountered in contemporary research: examination of data with visualization techniques, numerical analysis, and methods of dissemination and verification. No prior programming experience is required. T. Herring, C. Hill

12.011J Archaeological Science
(Same subject as 3.985J, 5.24J)
Prereq: 3.091, 5.11, 5.111, 5.112, or 8.01
U (Spring)
3-1-5 HASS

See description under subject 3.985J. H. N. Lechtman, J. Stubbe, F. A. Frey

12.080 EAPS Undergraduate Seminar
Prereq: —
U (Fall, Spring)
1-0-2 [P/D/F]
Can be repeated for credit

Covers topics in earth, atmospheric, and planetary sciences. Weekly seminars are presented by EAPS faculty members. Short weekly reading and writing assignments based on the seminar topics. Staff

12.085 Seminar in Environmental Science
Prereq: 12.120 and 12.103, or permission of instructor
U (Spring)
3-0-6

Stresses integration of central scientific concepts in environmental policy making and the chemistry, biology, and geology environmental science tracks. Revisits selected core themes for students who have already acquired a basic understanding of environmental science concepts. Potential topics include: geology, geochemistry and the politics of nuclear waste disposal; responsible environmental practices for planetary exploration; responsible coastal land-use policy; international regulations for protecting the open-ocean environment; the ecological impact of environmental change; and effective policy for dealing with natural hazards near major cities. D. H. Rothman

12.090 Special Topics in Earth, Atmospheric, and Planetary Sciences
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

12.091 Special Topics in Earth, Atmospheric, and Planetary Sciences
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Laboratory or field work in earth, atmospheric, and planetary sciences. Consult with department Education Office. EAPS Faculty

12.092 Special Topics in Geology and Geochemistry
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

12.093 Special Topics in Geology and Geochemistry
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Laboratory or field work in geology and geochemistry. To be arranged with department faculty. Consult with department Education Office. EAPS Faculty

12.094 Special Topics in Geophysics
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

12.095 Special Topics in Geophysics
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Laboratory or field work in geophysics. To be arranged with department faculty. Consult with department Education Office. EAPS Faculty
12.069 Special Topics in Atmospheric Science and Oceanography
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

12.097 Special Topics in Atmospheric Science and Oceanography
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Laboratory or field work in atmospheric science and oceanography. To be arranged with department faculty. Consult with department Education Office.
EAPS Faculty

12.098 Special Topics in Planetary Science
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

12.099 Special Topics in Planetary Science
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Laboratory or field work in planetary science. To be arranged with department faculty. Consult with department Education Office.
EAPS Faculty

Geology and Geochemistry

12.102 Environmental Earth Science
Prereq: —
U (Fall)
3-0-9 REST
The geologic record demonstrates that our environment has changed over a variety of time scales from seconds to billions of years. Explores the many ways in which geologic processes control and modify the Earth’s environment. Topics include chemical and physical interactions between the solid Earth, its oceans and atmosphere; the effect of catastrophic events such as volcanic eruptions and earthquakes on the environment; geologic hazards; and our role in modifying the environment through Earth resource development. Serves as an introduction to 12.120, which addresses field applications of these principles in the American Southwest.
S. A. Bowring

12.103 Strange Bedfellows: Science and Environmental Policy
Prereq: —
U (Fall)
3-0-9
Explores the role of scientific knowledge, discovery, method, and argument in environmental policymaking from both idealistic and realistic perspectives. Case studies of science-intensive environmental controversies used to study how science used and abused in the policy-making process. Case studies include global warming, biodiversity loss, and nuclear waste disposal siting. Includes intensive practice in the writing and presentation of position statements on environmental science issues.
Staff

12.104 Geochemistry of the Earth and Planets
Prereq: 18.02
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-1-8
Focuses on the processes that create chemical variability in the solid and fluid Earth, the moon, and meteorites. Includes nucleosynthesis, cosmochemistry, and basic geochemical concepts. Thermodynamics and phase equilibria are introduced and applied to problems of melting solid planetary interiors and the evolution of the Earth’s hydrosphere. Radiogenic and stable isotopic systems are used to document the timing of planetary formation and differentiation, formation, and evolution of volcanoes and continental crust, and to understand interactions between the solid and fluid Earth.
F. A. Frey, T. L. Grove

12.105 Experimental Investigations of the Charles River
Prereq: —
U (Fall)
3-3-6 Institute LAB
Charles River as a laboratory for studying transport mechanisms in a natural system. Students design and carry out sets of experiments intended to define mass and chemical fluxes, temperature, and channel bathymetry associated with the river system, with emphasis on the Charles River Basin. Students analyze resulting sets of data and summarize findings in class presentations.
Staff

12.108 Structure of Earth Materials
Prereq: 3.091, 5.11, 5.111, or 5.112
U (Spring)
3-4-5
Provides a comprehensive introduction to crystalline structure, crystal chemistry, and bonding in rock-forming minerals. Introduces the theory relating crystal structure and crystal symmetry to physical properties such as refractive index, elastic modulus, and seismic velocity. Surveys the distribution of silicate, oxide, and metallic minerals in the interiors and on the surfaces of planets, and discusses the processes that led to their formation.
T. L. Grove, S.-H. Shim

12.109 Petrology
Prereq: 12.108
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-6-3
Surveys the distribution, chemical composition, and mineral associations in rocks of the Earth’s crust and upper mantle, and establishes its relation to tectonic environment. Emphasis is on the use of chemistry and physics to interpret rock forming processes. Topics include dynamics of crust and mantle melting as preserved in the chemical composition of igneous rocks and minerals, the long-term record of global climate change as preserved in the minerals of sedimentary rocks, and the time-temperature-depth record preserved in minerals of metamorphosed crustal rocks.
T. L. Grove

12.110 Sedimentary Geology
(Subject meets with 12.465)
Prereq: 12.001
U (Spring)
3-3-6
J. B. Southard
12.111 Mechanics of Sedimentary Processes
(Subject meets with 12.452)
Prereq: Permission of instructor
U (Spring)
3-0-9
Studies aspects of flow and sediment-transport mechanisms relevant to understanding the construction of landscapes and depositional systems including modes of particle entrainment and motion in turbulent shear flows; sediment-bed configurations; channelization, erosion, and deposition of cohesive sediments; sediment gravity flows; and sorting of sediments by particle size and density. Interpretation of primary structures and textures in modern and ancient sedimentary deposits on the basis of sediment-transport mechanisms. Meets with 12.452 but assignments differ.
Staff

12.113 Structural Geology
Prereq: 12.001, 12.005
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-3-6
Introduces mechanics of rock deformation. Discusses recognition, interpretation, and mechanics of faults, folds, structural features of igneous and metamorphic rocks, and superposed deformations. Introduces regional structural geology and tectonics. Laboratory includes techniques of structural analysis, recognition and interpretation of structures on geologic maps, and construction of interpretive cross sections.
B. C. Burchfiel

12.114 Field Geology I
Prereq: 12.108, 12.113, or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
2-2-2
Introduces techniques of geological field study. Weather permitting, several weekend field exercises provide practical experience in preparation for 12.115. Presents introductory material on the regional geology of the locale of 12.115.
B. C. Burchfiel, Staff

12.115 Field Geology II
Prereq: 12.113, 12.114
Acad Year 2007–2008: U (IAP, Spring)
Acad Year 2008–2009: Not offered
0-18-0 Institute LAB
During January, students practice methods of modern geological field study during an intensive four-week subject. Exercises include geological and geomorphological mapping on topographic and photographic base maps of a wide variety of bedrock and surficial rocks. Where feasible, geochemical and geophysical field measurements are correlated with geology. Following term includes preparation of reports based on field studies conducted during January; report generally exceeds 30 pages in length and includes one major revision and rewrite. Instruction in writing techniques provided. Laboratory analysis of samples, interpretation of geological data, and where possible, geophysical and geochemical data. 12 units may be applied to the General Institute Laboratory Requirement.
Geology and Geochemistry Staff

12.119 Analytical Techniques for Studying Environmental and Geologic Samples
Prereq: —
U (Spring)
2-6-4 Institute LAB
Focuses on analytical facilities that are used to determine elemental and isotopic abundances in soils, rocks, minerals, and fluids. Emphasis is on isotopic ratios Sr, Nd, and Pb, whose isotopic ratios can be used for geochronology, and abundances of trace elements such as Rb, Sr, Cu, Cd, Hg, rare-earths, Pb, Th, and U. Analytical techniques include mass spectrometry, emission spectrometry, atomic absorption, neutron activation, and electron microprobe. A major lab project utilizes these techniques to address specific environmental and geologic problems. S. Bowring, E. Boyle, F. Frey, T. Grove

12.120 Environmental Earth Science Field Course
Prereq: 12.001, 12.102, or permission of instructor
U (IAP)
1-5-0
Introduction to the broad field of environmental geology, including volcanism and volcanic hazards, debris flows and mass movements, earthquakes, geothermal power, hazard assessment in areas with recent seismic and volcanic activity, and the problem of water availability vs. population growth in the western US. Fieldwork in western locations, typically Nevada and California.
S. Bowring, T. L. Grove

12.141 Electron Microprobe Analysis
Prereq: —
U (IAP)
1-1-4 [P/D/F]
Introduction to the theory of x-ray microanalysis through the electron microprobe including ZAF matrix corrections. Techniques to be discussed are wavelength and energy dispersive spectrometry, scanning backscattered electron, secondary electron, cathodoluminescence, and x-ray imaging. Lab sessions involve use of the electron microprobe.
T. Grove, N. Chatterjee

12.159 Sedimentary and Surficial Geology Investigations
(Subject meets with 12.459)
Prereq: 12.110 or permission of instructor
U (Spring)
3-6-3
Can be repeated for credit
See description under subject 12.459.
D. Rothman

12.162 Geological Image Interpretation
(Subject meets with 1.733J, 12.462)
Prereq: 12.001 or 1.32; 12.421J or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-3-6
Meets with subject 12.462, but assignments differ. Enrollment limited to 12 students. See description under subject 12.462.
Staff

12.163 Surface Processes and Landscape Evolution
(Subject meets with 12.463)
Prereq: 12.001 or 1.32; 1.61 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-3-6
Meets with subject 12.463, but assignments differ. See description under subject 12.463.
Staff

Geophysics

12.201 Essentials of Geophysics
(Subject meets with 12.501)
Prereq: 8.02, 18.03
U (Fall)
4-0-8
See description under subject 12.501.
R. D. van der Hilst
12.207J Nonlinear Dynamics II: Continuum Systems
(Same subject as 18.354J)
Prereq: 18.353J/12.006 or permission of instructor
U (Spring)
3-0-9 (H except 18)
See description under subject 18.354J.
J. W. Bush

12.213 Alternate Energy Sources
Prereq: —
U (IAP)
1-4-1 [P/D/F]
Can be repeated for credit
Explores a number of alternative energy sources such as geothermal energy (heat from the Earth’s interior), wind, natural gas, and solar energy. Includes a field trip to visit sites where alternative energy is being harvested or generated. Content and focus of subject varies from year to year.
M. N. Toksöz, F. D. Morgan

12.214 Environmental Geophysics
(Subject meets with 12.507)
Prereq: 18.03
U (Spring)
3-3-6
Meets with subject 12.507, but assignments differ. See description under subject 12.507.
F. D. Morgan

12.215 Modern Navigation
Prereq: —
U (Fall)
3-1-8
Introduces the concepts and applications of navigation techniques using celestial bodies and satellite positioning systems such as the Global Positioning System (GPS). Topics include astronomical observations, radio navigation systems, the relationship between conventional navigation results and those obtained from GPS, and the effects of the security systems, Selective Availability, and anti-spoofing on GPS results. Laboratory sessions cover the use of sextants, astronomical telescopes, and field use of GPS. Application areas covered include ship, automobile, and aircraft navigation and positioning, including very precise positioning applications.
T. A. Herring

12.221 Field Geophysics
Prereq: —
U (IAP)
1-4-1 [P/D/F]
Practical methods of modern geophysics including the Global Positioning System (GPS), gravity, and magnetics. Field work is conducted in western US and includes intensive 10-day field exercise. Focus is on measurement techniques and their interpretation. Introduction to the science of gravity, magnetics, and the GPS. Measure of crustal structure, fault motions, tectonic deformations, and the local gravity and magnetic fields. Students perform high-precision measurements and participate in data analysis. Emphasis on the principles of geophysical data collection and the relevance of these data for tectonic faulting, crustal structure, and the dynamics of the earthquake cycle.
T. A. Herring, B. H. Hager

12.222 Field Geophysics Analysis
Prereq: 12.221
U (Spring)
2-0-4
Aims to focus on in-depth data analysis and the development of the skills needed for the reporting of results both in writing and orally. In weekly meetings, students use data collected in 12.221 to develop written and oral reports of the results. Each student focuses on a different area of the results. For example, students can develop the geophysical modeling of the results or synthesis of the results into other studies in the area. The final written and oral reports from the students are structured so that they can be combined into a comprehensive report of the field camp and its results. A final oral presentation of results is required during the final few weeks of the spring semester.
T. A. Herring, B. H. Hager

12.265J Techniques in Remote Sensing
(Same subject as 1.717J)
(Subject meets with 12.565J)
Prereq: Permission of instructor
Acad Year 2007–2008: U (IAP)
Acad Year 2008–2009: Not offered
1-4-1 [P/D/F]
See description under subject 12.565.
M. Zuber

Atmospheres, Oceans, and Climate

12.300J Global Change Science
(Subject meets with 10.571J, 12.806J)
Prereq: 5.61, 18.075, or permission of instructor
U (Fall)
3-0-9
Meets with subject 12.806J, but assignments differ. See description under subject 12.806J.
R. G. Prinn, G. J. McRae

12.307 Weather and Climate Laboratory
Prereq: 18.02, 8.01
U (Spring)
1-4-7 Institute LAB
A laboratory subject intended to illustrate, by means of hands-on projects, the basic dynamical and physical principles which govern the general circulation of the atmosphere and the day-to-day sequence of weather events. Real-time meteorological observations are studied together with laboratory fluid experiments. Projects based on real-time observations stress the analysis and dynamical interpretation of the real phenomena, while complementary rotating tank experiments stress planning and testing of ideas in a more controlled laboratory environment. Written critical summaries of the results of each project and oral presentations are an integral part of the subject.
L. Illari, A. Plumb, J. Marshall

12.310 An Introduction to Weather Forecasting
Prereq: 8.01, 18.01
U (IAP)
1-1-4 [P/D/F]
Basic principles of synoptic meteorology and weather forecasting. Analysis of hourly weather
12.311 Experimental Oceanography
Prereq: —
U (IAP)
2-2-2 [P/D/F]
Can be repeated for credit
An intensive introduction to the experimental aspects of oceanography, specifically in the areas of marine geology and geophysics, physical oceanography, and chemical oceanography. Includes participation in a research cruise. Content varies from year to year.
J. Marshall, R. van der Hilst, WHOI Staff

12.320J Introduction to Hydrology
(Same subject as 1.070J)
Prereq: 1.060, 1.061, 1.106
U (Fall)
3-0-9
See description under subject 1.070J.
D. Entekhabi

12.330J Fluid Physics
(Same subject as 8.292J)
Prereq: 8.044J, 5.60, or permission of instructor
U (Spring)
3-0-9
See description under subject 8.292J.
P. Joss

12.333 Atmospheric and Ocean Circulations
Prereq: 12.003
U (Spring)
3-0-9
Survey of atmospheric and oceanic phenomena including the discussion of observations and theoretical interpretations. Topics covered include monsoons, El Niño, planetary waves, atmospheric synoptic eddies and fronts, gulf stream rings, hurricanes, surface and internal gravity waves, and tides.
R. A. Plumb

12.335 Experimental Atmospheric Chemistry
(New)
Prereq: 5.111 or 5.112
U (Fall)
2-4-6
Introduces the atmospheric chemistry involved in climate change, air pollution, and ozone depletion using a combination of interactive laboratory and field studies and simple computer models. Uses instruments for trace gas and aerosol measurements and methods for inferring fundamental information from these measurements.
R. Prinn

12.400 The Solar System
Prereq: 8.01
U (Spring)
3-0-9 REST
Introduction to the study of the solar system with emphasis on the latest spacecraft results. Subject covers basic principles rather than detailed mathematical and physical models. Topics include an overview of the solar system, planetary orbits, rings, planetary formation, meteorites, asteroids, comets, planetary surfaces and cratering, planetary interiors, planetary atmospheres, and life in the solar system.
R. P. Binzel

12.402J Introduction to Astronomy
(Same subject as 8.282J)
Prereq: 8.01
U (Spring)
3-0-9 REST
See description under subject 8.282J.
Staff

12.409 Hands-On Astronomy: Observing Stars and Planets
Prereq: —
U (Spring)
0-4-2 [P/D/F]
Background for and techniques of visual observation, electronic imaging, and spectroscopy of the Moon, planets, satellites, stars, and brighter deep-space objects. Weekly outdoor observing sessions using 8-inch diameter telescopes when weather permits. Indoor sessions introduce needed skills. Introduction to contemporary observational astronomy including astronomical computing, image and data processing, and how astronomers work. Student must maintain a careful and complete written log which is graded. Limited enrollment with priority to freshmen. Consumes an entire evening each week; 100% attendance at observing sessions required to pass.
M. T. Zuber and J. L. Elliot

12.410J Observational Techniques of Optical Astronomy
(Same subject as 8.287J)
Prereq: 8.03; 8.282J, 12.402J, 12.409 or other introductory astronomy course
U (Fall)
3-4-8 Institute LAB
Fundamental physical and optical principles used for astronomical measurements at visible wavelengths and practical methods of astronomical observations. Topics: astronomical coordinates, time, optics, telescopes, photon counting, signal-to-noise ratios, data analysis (including least-squares model fitting), limitations imposed by the Earth’s atmosphere on optical observations, CCD detectors, photometry, spectroscopy, astrometry, and time variability. Project at Wallace Astrophysical Observatory. Written and oral project reports. Enrollment limited to 24 students, with priority given to Course 8 and Course 12 majors and minors.
J. L. Elliot

12.411 Astronomy Field Camp
Prereq: 12.410J or 8.287J
U (IAP)
0-6-3 [P/D/F]
Can be repeated for credit
Individual research projects in observational astronomy involving supervised work at Lowell Observatory (located in Flagstaff, AZ). Written and oral reports required. Enrollment limited to 6.
J. L. Elliot

12.420 Physics and Chemistry of the Solar System
Prereq: 8.03, 12.002 or permission of instructor
U (Spring)
3-0-9
Advanced applications of physical and chemical principles to the study of the solar system. Topics include terrestrial and giant planets, meteorites, asteroids, comets, Kuiper belt objects, rings, impact craters, interiors, surfaces, atmospheres, geomagnetism, cosmochemistry, remote sensing, formation and evolution of the solar system.
B. Weiss

12.421J Physical Principles of Remote Sensing
(Same subject as 1.076J)
(Subject meets with 1.718J, 12.621J)
Prereq: 8.03
U (Fall)
3-0-9
Spacecraft and Earth-based remote sensing techniques used to study the Earth and other planets, satellites, asteroids, and comets.
Emphasizes the physics of electromagnetic radiation to achieve an understanding of remote sensing applications including visible and infrared imaging, spectroscopy, microwave, radar, lidar, and in situ measurements. Recent results from spacecraft emphasized.

R. P. Binzel

12.425 Extrasolar Planets: Physics and Detection Techniques (New)
Prereq: 8.01, 18.01
U (Fall) 2-1-9 REST

Basic principles of planet atmospheres and interiors applied to the study of extrasolar planets. Focus on fundamental physical processes related to observable extrasolar planet properties. Quantitative overview of detection techniques. Introduction to the feasibility of the search for Earth-like planets, biosignatures and habitable conditions on extrasolar planets.

S. Seager

GRADUATE SUBJECTS

12. ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit Can be repeated for credit

Program of research leading to the writing of an SM, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member.

Consult Department Headquarters

Geology and Geochemistry

12.445 Written and Oral Communication in the Earth, Atmospheric, and Planetary Sciences
Prereq: Permission of instructor
G (Fall) 2-0-4 H-LEVEL Grad Credit

Concentrated instruction and practice in professional writing and oral presentation within the context of the earth, atmospheric, and planetary sciences. Specifically designed to complement the SM degree program in Geosystems, but also ideal for other graduate students in Course 12 who wish to improve their communication skills. Topics include review of the many communication styles prevalent in the field; strategies for tailoring reports, technical papers, and presentations for specific audiences; and mechanics of organization and style. Weekly assignments in writing or speaking with peer and instructor feedback. Students are expected to develop and publicly defend a research proposal as part of the subject. For Geosystems students, this proposal anticipates the thesis required for completion of the SM degree program.

D. Morgan

12.450 Seminar in Geology and Geochemistry
Prereq: Permission of instructor
G (Spring) 2-0-4 [P/D/F] H-LEVEL Grad Credit Can be repeated for credit

Seminar on topics of current interest in geology and geochemistry. Required background preparation for students taking predoctoral general examinations in these subjects.

Geology and Geochemistry Staff

12.451 Seminar in Regional Tectonics
Prereq: Permission of instructor
G (Fall, Spring) 3-0-6 [P/D/F] H-LEVEL Grad Credit Can be repeated for credit

Applies techniques of tectonic synthesis to study the roles of particular orogenic belts in global plate tectonics. Treats different applications in different terms, so that the subject may be taken repeatedly to learn the range of orogenic responses to temporal and spatial variations of activity at plate boundaries.

B. C. Burchfied, J. P. Grotzinger, K. V. Hodges, L. H. Royden

12.452 Mechanics of Sedimentary Processes
(Subject meets with 12.111)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 12.111.

Staff

12.453–12.454 Crosby Lectures in Geology
Prereq: Permission of instructor
G (Fall, Spring) 3-0-6 [P/D/F] H-LEVEL Grad Credit Can be repeated for credit

A series of presentations on an advanced topic in the field of geology by the visiting William Otis Crosby lecturer. The Crosby lectureship is awarded to a distinguished international scientist each year to introduce new scientific perspectives to the MIT community. Subject content and structure vary from year to year.

Consult Department Headquarters

12.455 Megascopic Strain Analysis in Orogenic Belts
Prereq: 12.113
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall) 3-0-6 H-LEVEL Grad Credit

Introduction to modern techniques used to estimate the magnitude of strain in orogenic belts. Emphasis on megascopic strain analysis. Includes methods of determining sense of shear in various structural settings; the construction of 2-D balanced structural sections; the construction of 3-D structural sections; and graphical reconstruction of 2-D and 3-D sections to pre-deformational configurations.

Staff

12.456 Seminar in Rock Mechanics
Prereq: Permission of instructor
G (Fall, Spring) 2-0-4 [P/D/F] H-LEVEL Grad Credit Can be repeated for credit

Discussion of current research or advanced topics in continental tectonics, rock mechanics, or experimental structural geology.

B. Evans

12.457 Sedimentary Basins
Prereq: 18.03, 12.113
G (Spring) 3-0-6 H-LEVEL Grad Credit

Formation and evolution of basin systems in continental crust (including passive continental margins, foredeep accretionary basins, back-arc type basins, intraplate rifts, etc.) are examined with regard to tectonic settings, structural and sedimentary features, and deep lithospheric processes. Case studies of several sedimentary basins of each type.

L. H. Royden

12.458 Molecular Biogeochemistry
Prereq: Basic knowledge of organic chemistry
G (Fall) 2-0-4 [P/D/F] H-LEVEL Grad Credit

Covers all aspects of molecular biosignatures from their pathways of lipid biosynthesis, the distribution patterns of lipid biosynthetic pathways with regard to phylogeny and physiology, isotopic contents, occurrence in modern organisms and environments, diagenetic pathways, analytical techniques and the occurrence of molecular fossils through the geological record. There are several instructor lectures for background but the main emphasis is on detailed analysis of the recent literature on chemical fossils.

R. Summons
12.459 Sedimentary and Surficial Geology Investigations
(Subject meets with 12.159)
Prereq: Permission of instructor
G (Spring)
3-6-3 H-LEVEL Grad Credit
Can be repeated for credit

In-depth examination of modern and ancient depositional systems, Earth-surface landforms, and surficial processes, utilizing concepts of process sedimentology and geomorphology, sequence stratigraphy, and sedimentary basin analysis.

D. Rothman

12.460–12.461 Special Problems in Geology-Geochemistry
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Special investigations, special laboratory work, or special fieldwork in geology, petrology, mineralogy or geochemistry. 12.460 is letter-graded.

12.462 J Geological Image Interpretation
(Same subject as 1.733J)
(Subject meets with 12.162)
Prereq: 12.001 or 1.32; 12.421 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-3-6 H-LEVEL Grad Credit

Emphasizes methods of geological interpretation of remotely sensed image data. Students are challenged with a series of images from which the group must, with guidance, draw relevant conclusions about the geology/geomorphology of the area represented. Images selected may include topographic or bathymetric maps, aerial photographs, satellite images, seafloor side-scan sonar images, scenes from Mars, the moons of Jupiter, etc., and include both printed and digital formats. Emphasis on general principles rather than specific applications. Methods of digital image enhancement discussed. Grades based on biweekly projects-written reports, maps, processed digital images, and interpretive cross-sections. Meets with undergraduate subject 12.162J, but assignments differ. Enrollment limited to 12.

Staff

12.463 Surface Processes and Landscape Evolution
(Subject meets with 12.163)
Prereq: 12.001 or 1.32; 1.61 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-3-6 H-LEVEL Grad Credit

Examines the interaction of climate, tectonics, and surface processes in the sculpting of the Earth’s surface. Quantitative introduction to mechanics of fluvial, hillslope, and glacial processes. Essentials of weathering, soil formation, runoff, erosion, slope stability, sediment transport, river morphology, glacial erosion, and volcanism. System responses to climatic and tectonic forcings, including: glaciation, sea level change, uplift, subsidence, and post-glacial isostatic rebound. Additional instruction in: computer modeling in the study of surface processes, image analysis, and GIS applications in surface hydrology and slope stability.

Staff

12.464 Seminar in Sedimentary Geology
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit

Discussion of current research or advanced topics in sedimentary geology including, but not restricted to, sediment transport, interactions between sedimentation and stratigraphic architecture, sedimentary geochemistry, carbonate platform development, and paleontology.

Staff

12.465 Sedimentary Geology
(Subject meets with 12.110)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-3-6 H-LEVEL Grad Credit

See description under subject 12.110.

J. Southard

12.467 Seminar in Geomorphology
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit

Discussion of current research or advanced topics in landscape evolution, surface hydrology, mechanics of sediment transport, basin analysis, or experimental geomorphology. Advanced instruction in process geomorphology.

Staff

12.474 Origin and Evolution of the Earth’s Crust
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit

Broad overview of the origin and evolution of Earth’s crust and mantle with emphasis on the study of the Precambrian rock record. Topics include: processes of crustal growth, stabilization, and reactivation; evaluation of secular change; and use of radiogenic isotopes in geochronology and as tracers of crust forming processes.

S. Bowring, S. Rondenay

12.475 Plate Tectonics and Continental Deformation
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit

First half covers basic elements of plate tectonics, including sea floor spreading, magnetic anomalies, and subduction zone. Second half covers implications of plate tectonics for continental processes, including continental rifting, continental collision, and mountain building. Emphasis will be on correlating plate tectonic and continental processes using specific examples from around the world.

B. C. Burchfiel, L. H. Hayden

12.476 Radiogenic Isotope Geology
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit

Applications of the variations in the relative abundance of radiogenic isotopes to problems of petrology, geochemistry, and tectonics. Topics: geochronology; isotopic evolution of earth’s crust and mantle; petrogenesis; and analytical techniques.

S. Bowring

12.477 Tectonic Geomorphology and Low Temperature Thermochronology
Prereq: 18.03, 12.463, 12.476
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-3-6 H-LEVEL Grad Credit

Advanced topics in the study of the interactions among climate-driven surface processes, surface topography, heat transport, and rock deformation in the evolution of orogenic systems. The
geomorphic component emphasizes (1) critical problems in understanding river incision into bedrock, which governs the relation between topographic form (relief, mean elevation) and the rates and patterns of erosion, and (2) the nature and strength of feedbacks between erosion and deformation. The thermochronometry component emphasizes the co-evolution of the thermal field with topography and denudation rate, and outlines quantitative methods for, and limitations of, use of low temperature thermochronology (40Ar/39Ar, Fission Tracks, and (U-Th)/He) for discovering the history of topographic relief and denudation rate.

Staff

12.478 Pressure-Temperature-Time Evolution of Organic Belts
Prereq: 3.01 or 5.60; 12.109, 18.03
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit
Multidisciplinary introduction to modern techniques used to analyze burial and uplift histories of metamorphic terrains. Includes: geochronologic systems; closure temperature theory and the use of geochronologic systems as thermochronometers; geothermometry and geobarometry; thermodynamic modeling of P-T paths; thermal structure of orogenic belts, with emphasis on characteristic length scales and time scales for thermal events; and geophysical analysis of burial and uplift trajectories for metamorphic terrains.
L. H. Royden

12.479 Trace-Element Geochemistry
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Focuses on element distribution in rocks and minerals using data obtained from natural and experimental systems. Emphasizes models describing trace-element partitioning and applications of trace-element geochemistry to problems in igneous geology.
F. A. Frey

12.480 Thermodynamics for Geoscientists
Prereq: 5.60 or 3.00
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit
Principles of thermodynamics are used to infer the physical conditions of formation and modification of igneous and metamorphic rocks. Includes phase equilibria of homogeneous and heterogeneous systems and thermodynamic modelling of non-ideal crystalline solutions. Surveys the processes that lead to the formation of metamorphic and igneous rocks in the major tectonic environments in the Earth’s crust and mantle.
T. L. Grove

12.481 Advanced Field Geology I
Prereq: 12.108, 12.113, 12.114, 12.115
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-2-2 H-LEVEL Grad Credit
Can be repeated for credit
Introduction to the problems to be investigated in 12.482, as well as the regional setting and local geology of the field area. Various special techniques may be introduced and preparatory investigations may be conducted that are specific to the area to be studied in 12.482.
B. C. Burchfiel, Staff

12.482 Advanced Field Geology II
Prereq: 12.481
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
In January, a geological and geomorphological study of a selected field area is conducted during a four-week excursion. The following term includes: preparation of maps and report based on field study conducted in January; and laboratory analysis of samples.
B. C. Burchfiel, Staff

12.484 Directed Field Studies
Prereq: Permission of instructor
G (IAP)
0-6-0
Can be repeated for credit
Intensive training in field geological methods. Includes specific exercises selected to complement the backgrounds of the students enrolled and provides supervised experience in applying field analytical techniques to geological problems. Cannot be taken as a substitute for 12.115. Preference will be given to students associated with Course 12. Enrollment is limited and students should apply early.
B. C. Burchfiel, Staff

12.485 Advanced Directed Field Studies
Prereq: 12.484
G (IAP)
0-6-0
Can be repeated for credit
Continuation of 12.484. Designed to provide more advanced training in specific field geologic methods. Can be taken during the same IAP period as 12.484. Preference will be given to students associated with Course 12. Enrollment is limited and students should apply early.

Staff

12.488 Special Problems in Structural Geology
Prereq: —
G (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

12.489 Special Problems in Structural Geology
Prereq: —
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Special investigations, special laboratory work, or special fieldwork in structural geology.

Geology and Geochemistry Staff

12.490–12.491 Advanced Seminar in Geology and Geochemistry
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Problems of current interest in geology and geochemistry. Subject matter varies from term to term. 12.490 is letter-graded.

Geology and Geochemistry Staff

Geophysics

12.501 Essentials of Geophysics
(Subject meets with 12.201)
Prereq: 8.02, 18.03
G (Fall)
4-0-8 H-LEVEL Grad Credit
Overview of basic topics in solid-earth geophysics, such as the Earth’s rotation, gravity and magnetic field, seismology, and thermal structure. Formulation of physical principles presented in three one-hour lectures per week. Current applications discussed in an additional one-hour tutorial each week.
R. D. van der Hilst

12.507 Environmental Geophysics
(Subject meets with 12.214)
Prereq: 18.03
G (Spring)
3-3-6
Introduction to basic geophysical methods that can be used for environmental site characterization and shallow geological investigations. Techniques include seismic, electrical, and electromagnetic sounding; ground-penetrating radar,
magnetics, gravity, and borehole geophysics. Lectures emphasize basic principles and a physical understanding of the geophysical methods with environmental and engineering applications in mind. Some specific case histories are included. A few weekends of field measurements at representative local sites are included. Lab sessions cover modeling and interpretation of geophysical field data.

F. D. Morgan

12.510 Introduction to Seismology
Prereq: 18.075 or 18.085
G (Spring)
3-1-8 H-LEVEL Grad Credit
A basic study in seismology and the utilization of seismic waves for the study of Earth’s interior. Introduces techniques necessary for understanding of elastic wave propagation in stratified media and for calculation of synthetic seismograms (WKB) and mode summation. Ray theory; interpretation of travel times. (e.g., tomography); surface wave dispersion in layered media; Earth’s free oscillations; and seismicity, (earthquake locations, magnitude, moment, and source properties).
R. D. van der Hilst

12.515 Data and Models
Prereq: 18.075 or 18.085
G (Fall)
3-0-9 H-LEVEL Grad Credit
Surveys a number of methods of inverting data to obtain model parameter estimates. Topics include review of matrix theory and statistics, random and grid-search methods, linear and nonlinear least squares, maximum-likelihood estimation, ridge regression, stochastic inversion, sequential estimation, singular value decomposition, solution of large systems, genetic and sequential estimation, singular value decomposition, ridge regression, stochastic inversion, random and grid-search methods, linear and nonlinear fluids, and viscoelastic.
B. H. Hager

12.520 Geodynamics
Prereq: 12.005; 18.075 or 18.085
G (Fall)
3-0-9 H-LEVEL Grad Credit
Mechanics of deformation of the crust and mantle, with emphasis on the importance of different rheological descriptions: brittle, elastic, linear and nonlinear fluids, and viscoelastic.
B. H. Hager

12.521 Computational Geodynamics Modeling
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit
An introduction to theory, design, and practical methods of computational modeling in geodynamics. Covers the most effective and widely used numerical modeling approaches and emphasizes problem-solving skills through illustrative examples of heat and mass transfer in the mantle, mechanisms of lithosphere deformation, and other meso-scale geodynamical topics. Students acquire experience with various numerical methods through regularly assigned computational exercises and a term-long modeling project of each student’s choice.
J. Lin and L. Montesi

12.522 Geological Fluid Mechanics
Prereq: 8.03; 18.076 or 18.085
G (Fall)
3-0-9 H-LEVEL Grad Credit
Treats heat transfer and fluid mechanics in the Earth, low Reynolds number flows, convection instability, double diffusion, Non-Newtonian flows, flow in porous media, and the interaction of flows with accreting and deforming boundaries. Applications include: the flow under plates, postglacial rebound, diapirism, magma dynamics, and the mantle convection problem.
J. A. Whitehead (WHOI)

12.524 Mechanical Properties of Rocks
Prereq: 8.03, 18.03
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
A survey of the mechanical behavior of rocks in natural geologic situations. Topics: brief survey of field evidence of rock deformation, physics of plastic deformation in minerals, brittle fracture and sliding, and pressure-solution processes. Results of field petrologic and structural studies compared to data from experimental structural geology.
B. Evans

12.525 Mechanisms of Faulting and Earthquakes
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Explores the fundamental mechanisms of faulting and earthquakes from four related perspectives: seismology, geodesy, geodynamics, and rheology. Topics to be covered include (1) the physical processes that control the rheology of faults, including friction and fracture, (2) how these rheological processes are manifest in faulting and earthquakes in the earth from a geodynamics perspective, and (3) how the mechanics of faulting and earthquakes are constrained by seismological and geodetic observations. Both continental and oceanic examples of faulting and earthquakes will be featured.
J. Lin, G. Hirth, J. McGuire

12.533 Rock Physics
Prereq: Permission of instructor
G (Spring)
3-3-6 H-LEVEL Grad Credit
Fundamentals of experimental and theoretical rock physics taught at an advanced level. Rocks viewed as complex composite media with behavior dependent both on the physical and chemical properties of the constituent phases, and on their geometries. Electrical, fluid transport, and seismic properties covered in detail. Other topics such as magnetic, mechanical, and thermal responses briefly discussed. Weekly laboratory.
F. D. Morgan
12.540 Principles of Global Positioning System
Prereq: 8.01, 18.02, 18.06
G (Spring)
3-1-8 H-LEVEL Grad Credit
The principles and applications of the Global Positioning System (GPS) and other space geodetic systems, including very-long-baseline interferometry (VLBI) and satellite laser ranging (SLR). The nature and uses of the course acquisition (CA), the precise positioning (P) codes, and the differential carrier phase observable. Techniques for estimating geodetic and geophysical quantities from these data. Other topics include: atmospheric refraction modeling, effects of Selective Availability (SA), estimation techniques (including Kalman filtering). Statistical and spectral analysis of data.
T. A. Herring

12.552 Advanced Seismology: Theory and Applications of Seismic Imaging
Prereq: 12.510
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit
Introduces fundamental principles of seismic imaging used in both exploration and solid earth applications. Topics include ray theoretical approaches, scattering theory, and seismic waveform modeling. Through lectures, projects and student-led discussions of journal articles, the class covers the whole process of seismic imaging, from data preprocessing to model generation and geological interpretation of the results.
S. Rondenay

12.560–12.561 Special Seminar in Exploration Geophysics
Prereq: Permission of instructor
G (Fall, IAP, Spring)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Advanced seminar focusing on areas of current interest in exploration geophysics and seismology. Taught by visiting lecturers. 12.560 is letter-graded.
Geophysics Staff

12.565 Techniques in Remote Sensing
(Subject meets with 1.717J, 12.265J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (IAP)
Acad Year 2008–2009: Not offered
1-4-1 [P/D/F]
A practical introduction to techniques for observing the Earth from airborne and spaceborne platforms. Consists of three case studies in ocean, atmosphere, and land studies in which students observe the “end-to-end” process of making remote observations ranging from problem definition, sensor design, spacecraft accommodation, to data collection, analysis, and examination. Offered under the auspices of the Joint Center for Geoscience of MIT and the Goddard Space Flight Center, Greenbelt, MD. Part of subject taught at Goddard where students participate in tours of laboratories to observe sensor development in progress, mission operations facilities to view real-time data collection, and computational facilities to participate in data processing and analysis. Meets with undergraduate subject 12.265J. Graduate students are expected to explore the subject in greater depth.
M. Zuber

12.570 Topical Issues in Global Geophysics
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Series of formal lectures and seminars with the specific content varying by semester to reflect current issues in research. Meets jointly with relevant Harvard course.
R. D. van der Hilst

12.571 Seminar in Geophysics
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Problems of current interest in geophysics; subject matter varying from term to term.
Geophysics Staff

12.575 Introduction to Mineral Physics
Prereq: —
G (Fall)
3-0-9
Crystal structures of mantle and core minerals, elastic and thermodynamic properties of materials at high pressure-temperature, equations of state, phase diagrams of mantle and core minerals, and experimental and theoretical techniques in mineral physics. Some basic principles in thermodynamics, crystallography, and solid-state physics. Focus on laboratory or theoretical mineral physics data to interpret seismic observations and construct structure and dynamic models of the Earth and planetary interiors.
S.-H. Shim

12.580–12.581 Special Problems in Geophysics
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Special investigations, special laboratory work, or special fieldwork in geophysics. 12.580 is letter-graded.
Geophysics Staff

Planetary Science

12.601 Essentials of Planetary Science
Prereq: 8.03, 18.03
G (Spring)
3-0-9 H-LEVEL Grad Credit
Reviews fundamental physical concepts pertaining to the study of the solar system, and highlights recent spacecraft results. Topics include: meteorites, orbital dynamics, asteroids, impact craters, surfaces, atmospheres, atmospheric dynamics, interiors, magnetospheres, rings, comets, formation of the solar system.
B. Weiss

12.602 Asteroids and Small Bodies
Prereq: 8.02, 18.03
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduction to the study of asteroids and the ground-based and space-based techniques used to explore them. Topics include asteroid orbital properties, surface structure, physical properties, classifications, as well as their origin, thermal and collisional evolution, and interrelationships with meteorites and comets. Subject also covers the near-earth asteroids, the probabilities and consequences of terrestrial collisions, and the possible utilization of asteroids as space resources.
R. P. Binzel

12.603 Solar System Dynamics
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Introduction to chaotic behavior in conservative systems, with examples drawn primarily from the rotation and orbital dynamics of planets and satellites. Includes surfaces of section, Lyapunov exponents, perturbation theory, KAM theorem, resonances, onset of chaos, double pendulum, Henon-Heiles problem, restricted three-body problem, spin-orbit coupling, orbital resonanc-
es, adiabatic invariants, adiabatic chaos, tidal evolution, capture into resonance, and stability of the solar system.

J. Wisdom

12.611 Advanced Planetary Observations
Prereq: Permission of instructor
G (IAP)
0-6-3 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Astronomical observations involving several techniques are carried out at a major observatory, with focus on a particular set of objectives that change from year to year. Work includes: critical planning of the observations; acquiring the data; calculating the data; and on-site data reduction.

J. L. Elliot

12.616 Occultations, Eclipses, and Transits
Prereq: 8.03, 18.03 or 18.034
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Basic principles underlying occultation, eclipse, and transit phenomena, by solar system bodies and extra-solar planets, as observed throughout the electromagnetic spectrum from spacecraft and Earth-based platforms. Methods for predicting the times and locations where these phenomena will be visible and the techniques used for their observation. Data interpretation through physical modeling of the interaction (including gravitational lensing) of electromagnetic radiation with planetary limbs, rings, and atmospheres.

J. L. Elliot

12.620J Classical Mechanics: A Computational Approach
(Same subject as 6.946, 8.351J)
(Same subject as 12.008)
Prereq: 8.01, 18.03, 6.001, or equivalent G (Fall)
3-3-6 H-LEVEL Grad Credit


J. Wisdom, G. J. Sussman

12.621J Physical Principles of Remote Sensing
(Same subject as 1.718J)
(Same subject as 12.421J)
Prereq: 8.03
G (Fall)
4-0-8 H-LEVEL Grad Credit

Meets with undergraduate subject 12.421J, but assignments differ. Graduate students are expected to explore the subject in greater depth. Requires one extra class meeting per week.

R. P. Binzel

12.650 Current Topics in Planetary Science
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

In-depth discussion of current and classic literature on selected topics in planetary science. Topics vary from year to year.

J. Wisdom

12.690–12.691 Special Problems in Planetary Science
Prereq: —
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Special investigations, special laboratory work, or special fieldwork in planetary science. 12.690 is letter-graded.

Planetary Science Staff

Geological, Geophysical, and Chemical Oceanography

12.707 Pre-Pleistocene Paleooceanography and Paleoclimatology
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Climate history of the Earth from the formation of the early atmosphere and ocean to the present. Evaluation of geochemical, sedimentological, and paleontological evidence for changes in ocean circulation, global temperatures, and atmospheric carbon dioxide levels. Theories and models of Phanerozoic climate change. Long-term history of the global carbon cycle.

WHOI staff

12.708 Special Topics in Paleoclimateology
Prereq: Permission of instructor
G (Spring)

Can be repeated for credit

Advanced seminar focusing on areas of current interest in paleoceanography and paleoclimatology. Includes discussion of current and classic literature. Topics vary from year to year.

D. Oppo, J. McManus, O. Marchal (WHOI)

12.710 Marine Geology and Geophysics I
Prereq: Permission of instructor
G (Fall)
3-2-7 H-LEVEL Grad Credit

An introduction to marine geology and geophysics suitable for any student interested in the ocean sciences. Also intended as part of a two-semester sequence for first-year MIT-WHOI Joint Program students in marine geology and geophysics (M&G). Topics include: deposition and preservation of marine sediments, climate proxies, Cenozoic to Holocene climate history, paleoceanography, marine stratigraphy and geochronology, structure of the earth, structure of oceanic crust, evolution of the oceanic lithosphere, mantle geodynamics, plate tectonics, ocean altimetry, and coastal sediment processes.

J. McManus, R. Reves-Sohn, K. Sims

12.711 Marine Geology and Geophysics II
Prereq: 12.710
G (Spring)
3-2-7 H-LEVEL Grad Credit

An introduction to marine geology and geophysics intended as part of a two-semester sequence for first-year MIT-WHOI Joint Program students in marine geology and geophysics. Topics include: lithosphere evolution and mantle dynamics, the structure and composition of the oceanic crust and mantle, tectonic and magmatic processes at mid-ocean ridges, hotspot volcanism, subduction and arc magmatism, and the crustal structure and sedimentation history of continental margins.

N. Shimizu, D. Smith, S. Humphris

12.712 Advanced Marine Seismology
Prereq: 12.710/12.711
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit
Can be repeated for credit

Focuses on synthetic seismograms, ocean bottom reflection seismology, and multi-channel reflection seismology as applied to studies of the ocean sediments, crust, and lithosphere.
Topics include: the wave equations for elastic/anelastic, isotropic/anisotropic, homogeneous/heterogeneous and fluid/solid media; ray theory and WKBJ approximations; the Sommerfeld/Weyl integrals, asymptotic analysis, and Lamb's problem for a fluid/solid interface; reflectivity and related methods; finite difference and finite element methods; and special topics of interest to the class. Extensive readings of geophysical and seismological literature.

R. Stephen (WHOI)

12.714 Computational Data Analysis
Prereq: 18.03
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

An introduction to the theory and practice of analyzing discrete data such as are normally encountered in geophysics and geology. Emphasizes statistical aspects of data interpretation and the nonparametric discrete-time approach to spectral analysis. Topics include: elements of probability and statistics, statistical inference, robust and nonparametric statistics, the method of least squares, univariate and multivariate spectral analysis, digital filters, and aspects of multidimensional data analysis.

A. D. Chave, R. Sohn

12.716 Igneous Processes at Oceanic Margins
Prereq: 12.710, 12.711, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-2-4 H-LEVEL Grad Credit
Can be repeated for credit

Quantitative analysis of melting, melt transport, and igneous crustal accretion at oceanic spreading centers, rifted continental margins, and subduction-related arcs, applied to understanding variation in composition and volume of the Earth's crust in different tectonic environments. Theoretical methods for calculation of melt volume and composition, solid-liquid equilibria and reaction rates, and liquid density and viscosity combined with field, petrographic, geochemical, and computational techniques. Topics vary from year to year.

H. Dick, G. Gaetani (WHOI)

12.718 Kinetics and Mass Transport
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit

Offers a broad overview of various kinetic and transport processes in geology, including volume and grain boundary solid-state diffusion, defects in minerals, rates of mineral reaction and transformation, crystal nucleation and growth, advective transport in porous media and partially molten aggregates, and percolation theory. Emphasis on processes in crystalline rocks. Covers theoretical, phenomenological, and experimental constraints, with a consistent application to "real-world" settings and actual case histories.

G. Hirth, S. Hart (WHOI)

12.721 Special Problems in Marine Geology and Geophysics at Woods Hole
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Special investigations, special laboratory work, or special fieldwork in marine geology and geophysics.

WHOI Staff

12.722 Special Problems in Chemical Oceanography at Woods Hole
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

For graduate students desiring to perform special investigations, special laboratory work, or special fieldwork in chemical oceanography.

WHOI Staff

12.730–12.731 Special Problems in Marine Geology and Geophysics at MIT
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

For students in the MIT/WHOI Joint Program desiring to perform special investigations, special laboratory work, or special fieldwork in marine geology and geophysics under the supervision of a faculty member in residence at MIT. 12.730 is letter-graded.

Marine Geology and Geophysics Staff

12.735–12.736 Special Problems in Chemical Oceanography at MIT
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

For students in the MIT/WHOI Joint Program desiring to perform special investigations, special laboratory work, or special fieldwork in chemical oceanography under the supervision of a faculty member in residence at MIT. 12.735 is letter-graded.

Chemical Oceanography Staff

12.740 Paleoceanography
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

The history of the earth-surface environment is deduced from the records preserved in deep-sea sediments, ice cores, and corals. Micropaleontological, isotopic, geochemical, and mineralogical changes are used to infer changes in seawater composition, atmospheric chemistry, and climate. These observations are interpreted as consequences of changes in ocean temperature, circulation, and chemistry and used to evaluate theories proposed to account for glacial/interglacial cycles (e.g. orbital forcing). The past 2 million years are emphasized, but major processes and events from the past 100 million years are included.

E. A. Boyle

12.742 Marine Chemistry
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

An introduction to chemical oceanography. Reservoir models and residence time. Major ion composition of seawater. Inputs to and outputs from the ocean via rivers, the atmosphere, and the sea floor. Biogeochemical cycling within the oceanic water column and sediments, emphasizing the roles played by the formation, transport, and alteration of oceanic particles and the effects that these processes have on seawater composition. Cycles of carbon, nitrogen, phosphorus, oxygen, and sulfur. Uptake of anthropogenic carbon dioxide by the ocean. Material presented through lectures and student-led presentation and discussion of recent papers.

S. Doney, W. Martin, K. Casciotti, M. K. Tivey (WHOI)

12.743 Geochemistry of Marine Sediments
Prereq: 5.11, 5.111, 5.112, or 3.091; 5.60
G (Fall)
3-0-9 H-LEVEL Grad Credit

2007–2008
subjects 12.714 to 12.800

12.744 Marine Isotope Chemistry
Prereq: 12.748 or permission of the instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-4 H-LEVEL Grad Credit

Focuses on isotope systematics applied to important problems in marine chemistry, specifically isotopic systematics of light stable isotopes and intermediate mass stable isotope systematics.
W. Jenkins, J. Hayes (WHOI)

12.745 Ore Deposition at Submarine Ridge Axes
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Staff

12.746 Marine Organic Geochemistry
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

Provides an understanding of the distribution of organic carbon (OC) in marine sediments from a global and molecular-level perspective. Surveys the mineralization and preservation of OC in the water column and within anoxic and oxic marine sediments. Topics include: OC composition, reactivity and budgets within, and fluxes through, major reservoirs; microbial recycling pathways for OC; models for OC degradation and preservation; role of anoxia in OC burial; relationships between dissolved and particulate (sinking and suspended) OC; methods for characterization of sedimentary organic matter; application of biological markers as tools in oceanography. Both structural and isotopic aspects are covered.
D. Repeta, T. I. Eglinton (WHOI)

12.747 Modeling, Data Analysis, and Numerical Techniques for Geochemistry
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Emphasizes the basic skills needed for handling and assimilating data as well as the basic toolset for numerical modeling. Uses MATLAB as its computation engine; begins with an introduction to MATLAB to ensure familiarity with software. Topics include: probability distributions, error propagation, least squares and regression techniques, mass spectrometry, isotope fractionation, difference techniques, inverse models, and scientific visualization.
D. Glover, W. Jenkins, S. Doney (WHOI)

12.748 Introduction to Isotope Chemistry
Prereq: Permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit

Teaches fundamental aspects of isotope chemistry applied to the ongoing evolution of Earth and its major geochemical reservoirs (core, mantle, oceanic and continental crusts, seawater) in the context of solar system evolution. The course introduces students to nuclear physics, nucleosynthesis, mass spectrometry, isotope fractionation processes and the application of important isotope groups to fundamental processes in Earth’s chemical evolution.
W. Jenkins, J. Hayes, K. Sims (WHOI)

12.749 Solid Earth Geochemistry
Prereq: 12.748 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-4 H-LEVEL Grad Credit

Uses the isotopic methods and tools developed in 12.748, in conjunction with major and trace element systematics to examine in detail the fundamental processes of solid Earth accretion and differentiation. Introduces concepts of nebular condensation, meteorites and their parent bodies, origin and evolution of the moon, planetary differentiation, formation and evolution of the Earth’s mantle and crust, and magmatism in ocean basins.
K. Sims, G. Gaetani (WHOI)

12.751–12.759 Seminar in Oceanography at Woods Hole
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Topics in marine geology and geophysics, physical, dynamical, and chemical oceanography. Content varies from term to term. 12.754, 12.755, and 12.756 are letter-graded.
WHOI Staff

12.760–12.761 Seminar in Marine Geology and Geophysics at MIT
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Topics in marine geology and geophysics taught at MIT. Content varies from term to term. 12.760 is letter-graded.
Marine Geology and Geophysics Staff

12.770–12.771 Seminar in Chemical Oceanography at MIT
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Topics in chemical oceanography taught at MIT. Content varies from term to term. 12.770 is letter-graded.
Chemical Oceanography Staff

Atmospheres, Oceans, and Climate

12.800 Fluid Dynamics of the Atmosphere and Ocean
Prereq: 8.03, 18.04
G (Fall)
3-0-9 H-LEVEL Grad Credit

J. Pedlosky (WHOI)
12.801 Steady Circulation of the Oceans
Prereq: 12.800
G (Spring)
3-0-9 H-LEVEL Grad Credit

Fundamental principles in modeling steady flows in the ocean and their analogues in the atmosphere. Illustrates general methods that apply to either fluid and the contrasts between them. Includes quasi-geostrophy on the beta plane and planetary geostrophy on the sphere, Ekman pumping, wind- and thermally driven ocean circulation models, western-boundary current dynamics, and abyssal circulation.
K. Helfrich (WHOI)

12.802 Wave Motions in the Ocean and Atmosphere
Prereq: 12.800
G (Spring)
3-0-9 H-LEVEL Grad Credit

Basic ideas of geophysical water wave motion in rotating, stratified, and rotating-stratified fluids. Subject begins with general wave concepts of phase and group velocity. The dynamics and kinematics of gravity waves with a focus on dispersion, energy flux, initial value problems, etc. Subject foundation used to study internal and inertial waves, Kelvin, Poincare, and Rossby waves in homogeneous and stratified fluids. Laplace tidal equations are applied to equatorial waves. Other topics include: resonant interactions, potential vorticity, wave-mean flow interactions, and instability.
P. Rizzoli

12.803 Quasi-balanced Circulations in Oceans and Atmospheres
Prereq: 12.800, 12.804
G (Fall)
3-0-9 H-LEVEL Grad Credit

Dynamics of large-scale circulations in oceans and atmospheres, taken concurrently with the laboratory subject 12.804. Basic concepts include mass and momentum conservation, hydrostatic and geostrophic balance, and pressure and other vertical coordinates. Barotropic vorticity equation: potential vorticity (PV) and invertibility; Greens functions/point vortices; balance forced flow, waves, and vortices. Shallow water equations, geostrophic adjustment. Stratified atmospheres and oceans: thermodynamics. The quasi-geostrophic (QG) equations, pseudo potential vorticity. Barotropic and baroclinic instabilities and the Rayleigh, Fjortoft and Charney-Stern theorems. Eady and Charney models. The superposition theorem and the continuous spectrum. Effects of boundary friction, upward wave radiation, and phase change of water. Frontogenesis and semigeostrophy.
K. A. Emanuel

12.804 Large-scale Flow Dynamics Laboratory
Prereq: 12.800, 12.803
G (Fall)
0-3-6 H-LEVEL Grad Credit

Laboratory component of subject 12.803. Analysis of observations of oceanic and atmospheric quasi-balanced flows, computational models, and rotating tank experiments. Illustrates the basic principles of potential vorticity conservation and inversion, Rossby wave propagation, baroclinic instability, and the behavior of isolated vortices.
L. Illari, G. Flierl

12.805 Laboratory in Physical Oceanography
Prereq: 12.808
G (Spring)
2-2-5 H-LEVEL Grad Credit

An introduction to standard data analysis methods including time series analysis, objective mapping, empirical orthogonal functions, and dynamic analysis of hydrographic data. Emphasis on working with data in a computer laboratory setting using packaged software. Where appropriate, comparison is made with simple models. Some attention given to the instruments and algorithms used to acquire the data.
WHOI Staff

12.806 Atmospheric Physics and Chemistry
(Subject meets with 12.306)
Prereq: 5.61, 18.075, or permission of instructor
3-0-9 H-LEVEL Grad Credit

Introduction to the physics and chemistry of the atmosphere including experience with computer codes. Aerosols and theories of their formation, evolution, and removal. Gas and aerosol transport from urban to continental scales. Coupled models of radiation, transport, and chemistry. Solution of inverse problems to deduce emissions and removal rates. Emissions control technology and costs. Applications to air pollution and climate.
R. G. Prinn, G. J. McRae

12.807 Atmospheric Chemistry
Prereq: 5.60
3-0-9 H-LEVEL Grad Credit

Reviews chemical reactions and biogeochemical cycles that control the abundance of trace species in the troposphere and stratosphere. Emphasis is placed on the potentially damaging effects of human activity on the chemical balance of the atmosphere. Covers stratospheric ozone depletion, regional and local photochemical smog, and greenhouse gases. Meets with undergraduate subject 5.23, but assignments differ.

12.808 Introduction to Observational Physical Oceanography
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Results and techniques of observations of the ocean in the context of its physical properties and dynamical constraints. Emphasis on large-scale steady circulation and the time-dependent processes that contribute to it. Includes the physical setting of the ocean, atmospheric forcing, application of conservation laws, description of wind-driven and thermohaline circulation, eddy processes, and interpretive techniques.
J. Price (WHOI)

12.809 Hydraulic Phenomena in Geophysical Fluid Flows
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit

Examination of the hydraulics of nonrotating flows (Long’s experiments, hydraulic control, upstream influence, nonlinear wave steepening, hydraulic jump and bores, application to severe downslope winds). Other topics may include: nonrotating stratified flows (two-layer hydraulics, virtual and approach controls, maximal and submaximal flow, application to the Strait of Gibraltar and the Bab al Mandab); and deep ocean straits and sills (steady theories for rotating channel flow, nonlinear Kelvin and frontal waves, rotating hydraulic jumps, geostrophic adjustment in a rotating channel, and applications to the Denmark Strait and other deep passages).
L. Pratt (WHOI)

12.810 Dynamics of the Atmosphere
Prereq: 12.800
G (Spring)
3-0-9 H-LEVEL Grad Credit

and eddies in nonrotating and rotating fluids: specifically internal gravity waves, tides, Rossby waves, barotropic and baroclinic instabilities. The interaction of these asymmetric components of atmospheric motion with the zonally averaged circulation discussed. Emphasis on specific observed phenomena.

R. A. Plumb

12.811 Tropical Meteorology
Prereq: 12.810 or 12.803
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

A description of the large-scale circulation systems of the tropical atmosphere and analysis of the dynamics of such systems. Topics include: Radiative-convective equilibrium; the Hadley and walker circulation; monsoons; tropical boundary layers; theory of the response of the tropical atmosphere to localized sea-surface temperature anomalies; intraseasonal oscillations; equatorial waves; El Niño/Southern Oscillation; easterly waves; and tropical cyclones.

K. A. Emanuel

12.812 General Circulation of the Earth’s Atmosphere
Prereq: 12.810 or 12.803
G (Fall)
3-0-9 H-LEVEL Grad Credit

Diagnostic studies and discussion of their implications for the theory of the structure and general circulation of the Earth’s atmosphere. Includes some discussion of the validation and use of general circulation models as atmospheric analogs.

Staff

12.815 Atmospheric Radiation
Prereq: 5.61, 18.075 or permission of instructor
G (Fall)
2-2-2 H-LEVEL Grad Credit

Introduction to the physics of atmospheric radiation and remote sensing including use of computer codes. Radiative transfer equation including emission and scattering, spectroscopy, Mie theory, and numerical solutions. Solution of inverse problems in remote sensing of atmospheric temperature and composition.

R. G. Prinn, R. A. McClatchey

12.818 Introduction to Atmospheric Data and Synoptic Meteorology
Prereq: 12.800
G (Fall)
3-3-6 H-LEVEL Grad Credit

Provides a general introduction to meteorological data and analysis techniques, and their use in the MIT Synoptic Laboratory to study the phenomenology and dynamics of large-scale atmospheric flow. Balance concepts as applied to the dynamics of frontal and synoptic scales are illustrated using real-time upper air and surface station data and gridded analyzed fields. Advanced meteorological software packages are used to access, manipulate, and graphically display the data.

L. Illari

12.820 Turbulence and Nonlinear Waves in the Ocean and Atmosphere
Prereq: 12.803
G (Spring)
3-0-6 H-LEVEL Grad Credit

Introduction to turbulence in geophysical systems, including 3-D, 2-D, and quasi-geostrophic turbulence. Transition to turbulence through primary and secondary instabilities. Statistical theories of fully-developed turbulence. Influence of stratification and rotation. Parameterization of turbulent processes in ocean models.

R. Ferrari, G. Flierl

12.822 Nonlinear Waves and Vortices
Prereq: 18.305, 12.803
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit


G. Flierl

12.823 Modeling the Biology and Physics of the Ocean (New)
Prereq: 18.305, 12.803
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit

Principles and examples of the construction of physical/biological models for oceanic systems. Individual-based and continuum representations. Food webs and structured population models. Fluid transport, stirring, and mixing.

Effects of rotation and stratification. Advection, diffusion, reaction dynamics. Oceanic examples of physical-biological dynamics: surface mixed layer, upwelling regimes, mesoscale eddies, and oceanic gyres.

G. Flierl

12.824 Stability Theory for Oceanic and Atmospheric Flows
Prereq: 12.802 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Basic theory of hydrodynamic instability with special application to flows of interest in oceanography and meteorology. Topics covered include general formulation of stability theory; concept of normal modes and linearization; fundamental stability theorems; baroclinic instability: Charney model, Eady model and the Phillips two-layer model; energy transformations; initial value theory and non-modal instability; barotropic instability for jets and shear layers; radiating instabilities; initial value problems applied to the concepts of convective, absolute and spatial instabilities; finite amplitude theory; stability of non-parallel flows.

G. Flierl

12.826 Land-Atmosphere Interaction
(8.1.713 J)
Prereq: 1.070 J, 1.714, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 1.713 J.

D. Entekhabi

12.830 Topics in Waves and Instability
Prereq: 12.803; 12.802 or 12.810
G (Fall)
3-0-9 H-LEVEL Grad Credit

A detailed presentation of selected advanced topics in waves and instability in the atmosphere. The precise selection varies from year to year. Topics have included wave-mean flow interaction, the quasi-biennial oscillation, sudden warmings, critical-level behavior, wave overreflection, nonlinear equilibration, wave breaking, tropical waves, and stationary waves.

R. S. Lindzen
12.831 Dynamics and Transport in the Stratosphere
Prereq: 12.803 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

R. A. Plumb

12.834 Prediction and Predictability of the Atmospheres and Oceans
Prereq: Permission of the instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Forecasting is the ultimate form of model validation, but even if a perfect model is in hand, imperfect forecasts are likely. Taking a dynamical systems approach, this subject covers the factors that limit our ability to produce good forecasts, shows how the quality of forecasts can be gauged a priori (predicting our ability to predict!), and covers the state of the art in operational atmosphere and ocean forecasting systems.
J. Hansen

12.841 Climate Dynamics
Prereq: 12.801; 12.803 or 12.810
G (Spring)
3-0-9 H-LEVEL Grad Credit

Description of atmospheric and oceanic processes important in determining climate and climate change. Construction and application of simplified models of climate and climate change. Discussion of general circulation model studies of climate and climate change.
Staff

12.842 Climate Physics and Chemistry
(Subject meets with 12.301)
Prereq: 3.091, 5.11, 5.111, or 5.112; 18.03; or permission of instructor
G (Fall, IAP)
4-0-8 H-LEVEL Grad Credit

Introduction to climate studies, including beginnings of the solar system, time scales, and climate in human history; methods for detecting climate change, including proxies, ice cores, instrumental records, and time series analysis; physical and chemical processes in climate, including primordial atmosphere, ozone chemistry, carbon and oxygen cycles, and heat and water budgets; internal feedback mechanisms, including ice, aerosols, water vapor, clouds, and ocean circulation; climate forcing, including orbital variations, volcanism, plate tectonics, and solar variability; climate models and mechanisms of variability, including energy balance, coupled models, and global ocean and atmosphere models; and outstanding problems.
C. Wunsch, E. Boyle, K. Emanuel

12.848j Global Climate Change: Economics, Science, and Policy
(Same subject as 15.023, ESD.128j)
Prereq: 18.02; 5.60 or 2.005; 15.010
G (Spring)
3-0-6 H-LEVEL Grad Credit

See description under subject 15.023.
H. D. Jacoby, R. G. Prinn

12.861 Modern Observational Physical Oceanography
Prereq: 12.801 or 12.802, 12.864
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit

Subject provides physical oceanography students with a deeper understanding of how recent oceanic observation programs are changing the long-standing view of how the ocean behaves. Subject covers a variety of topics, with a focus on the ocean as a time-varying system ranging from short (days) to long (millennial) time-scales. New tools and new inferences discussed.
C. Wunsch

12.862 Coastal Physical Oceanography
Prereq: 12.800
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Introduction to the dynamics of flow over the continental shelf, emphasizing both theory and observations. Content varies somewhat according to student and staff interests. Possible topics include fronts, buoyant plumes, surface and bottom boundary layers, wind-driven upwelling, coastal-trapped waves, internal waves, quasi-steady flows, high-latitude shelf processes, tides, and shelf-open ocean interactions.
S. Lentz, C. Cenedese, J. Lerczak (WHOI)

12.863 Special Topics in Coastal Physical Oceanography
Prereq: 12.862 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit

More specialized topics in the dynamics of flow over the continental shelf, including coastal-trapped waves, wind-driving, and mean flows. Emphasis on the relationship between theory and observations. Instrumentation and the application of statistical techniques also covered.
Woods Hole Staff

12.864 Inference From Data and Models
Prereq: 18.075 or 18.086
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit

Fundamental methods used for exploring the information content of observations related to kinematical and dynamical models. Basic statistics and linear algebra for inverse methods including singular value decompositions, control theory, sequential estimation (Kalman filters and smoothing algorithms), adjoint/Pontryagin principle methods, model testing, etc. Second part focuses on stationary processes, including Fourier methods, z-transforms, sampling theorems, spectra including multi-taper methods, coherences, filtering, etc. Directed at the quantitative combinations of models, with realistic, i.e. sparse and noisy observations.
C. Wunsch

12.866 Theory of the General Circulation of the Ocean
Prereq: 12.800, 12.801, 12.802
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

R. X. Huang (WHOI)
12.870 Air-Sea Interaction: Boundary Layers  
Prereq: Graduate-level fluid mechanics and a subject on waves, or permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Addresses the interaction of the atmosphere and ocean on temporal scales from seconds to days and spatial scales from centimeters to kilometers. Topics include the generation, propagation, and decay of surface waves; the processes by which mass, heat, momentum, and energy are transported vertically within the coupled atmospheric and oceanic boundary layers and across the air-sea interface; and the statistical tools, mathematical models, and observational methods that are used to quantify these processes.  
J. Trowbridge, E. Terray (WHOI)

12.950–12.951 Seminar in Physical Oceanography at MIT  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Topics in physical and dynamical oceanography. Content varying from term to term. 12.950 is letter-graded.  
Physical Oceanography Staff

12.960–12.961 Special Problems in Physical Oceanography at MIT  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Special investigations, special laboratory work, or special fieldwork in oceanography. 12.960 is letter-graded.  
Physical Oceanography Staff

12.970–12.971 Special Problems in Physical Oceanography at Woods Hole  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Reading, consultation, and original investigation on oceanographic problems. 12.970 is letter-graded.  
Woods Hole Staff

12.980–12.981 Special Problems in Meteorology  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Reading, consultation, and original investigations on meteorological problems. 12.980 is letter-graded.  
Meteorology Staff

12.990–12.991 Special Subjects in Meteorology  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Organized lecture or laboratory subject on some aspect of meteorology not normally covered in regularly scheduled subjects. 12.990 is letter-graded.  
Consult Department Headquarters
13.ThG Graduate Thesis
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research leading to the writing of an
SM, PhD, or ScD thesis, to be arranged by the
student and an appropriate MIT faculty member.
Consult department headquarters.
M. S. Triantafyllou

13.UR Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

13.URG Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Research in engineering for the ocean environ-
ment, including naval architecture, wave energy,
seakeeping, ocean exploration, ocean transport-
ation, ocean vehicles, utilization of resources,
marine economics, systems analysis, marine
policy, marine hydrodynamics, ocean acoustics,
ocean structures, sailing yachts, and some
aspects of marine-related management. Hands-
on experimental research in modern laboratory
facilities.
A. H. Techet
14.03 Microeconomic Theory and Public Policy
(Subject meets with 14.003)
Prereq: 14.01
U (Fall, Spring)
4-0-8 HASS
See description under subject 14.003.
P. Jia

14.04 Intermediate Microeconomic Theory
Prereq: 14.01, 18.02
U (Fall)
4-0-8 HASS
Analysis of consumer and producer decisions including analysis of competitive and monopolistic markets. Price-based partial and general equilibrium analysis. Introduction to game theory as a foundation for the strategic analysis of economic situations. Imperfect competition, dynamic games among firms. Failures of general equilibrium theory and their resolutions: externalities, public goods, incomplete information settings, signaling, screening, insurance, alternative market mechanisms, auctions, design of markets.
M. Rysman

14.05 Intermediate Applied Macroeconomics
Prereq: 14.01, 14.02
U (Spring)
4-0-8 HASS
Uses the tools of macroeconomics to study various macroeconomic policy problems in depth. The problems range from economic growth in the long run to government finances in the intermediate run and economic stability in the short run. Many economic models used today are surveyed. Requires a 20-page paper on the economics of long-run economic growth.
P. Temin

14.06 Advanced Macroeconomics
Prereq: 14.05
U (Spring)
4-0-8 HASS
Topics in advanced macroeconomics including growth, business cycles, monetary and fiscal policy, consumption and investment under uncertainty, asset pricing, financial intermediation, coordination problems, and crises. Emphasis on models and techniques.
G. M. Angeletos

14.09 Reading Seminar in Economics
Prereq: 14.04, 14.06
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

14.10 Reading Seminar in Economics
Prereq: 14.04, 14.06
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Reading and discussion of particular topics in economics. Open to undergraduate students by arrangement with individual faculty members. Consult Department Headquarters.
J. Gruber

14.102 Mathematics for Economists
Prereq: 18.01, 18.02, 18.06
G (Fall)
4-0-8
Covers some topics in mathematics that are frequently used in economic theory and applications. Topics include: optimization theory (including optimal control and recursive methods); probability theory; topology (continuity, compactness); dynamical systems (including stability); convex analysis; and fixed point theory. Presentation of each topic self-contained.
Consult Department Headquarters

14.11 Special Topics in Economics
Prereq: 14.01
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall, Spring)
4-0-8 HASS
Can be repeated for credit
Considers issues of current research interest in economics.
Consult Department Headquarters
14.12 Economic Applications of Game Theory
Prereq: 14.01; 14.03, 6.041 or permission of instructor
U (Fall)
4-0-8 HASS
Analysis of strategic behavior in multi-person economic settings. Introduction to solution concepts, such as rationalizability, backwards induction, Nash equilibrium, subgame-perfect equilibrium, and sequential equilibrium, with a strong emphasis on the assumptions behind these solution concepts. Issues of incomplete information, such as signaling and reputation formation. Applications drawn from microeconomics and political economy.
M. Yildiz

14.121 Microeconomic Theory I
Prereq: 14.04 and permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit
Theories of production and individual choice (under certainty and uncertainty); markets and competition; tools of comparative statics and their application to price theory. Class size limited.
G. Ellison

14.122 Microeconomic Theory II
Prereq: 14.121 and permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit
Introduction to game theory. Class size limited.
G. Ellison

14.123 Microeconomic Theory III
Prereq: 14.121, 14.122, and permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
General equilibrium, capital theory, incomplete markets, externalities, public goods. Class size limited.
P. A. Diamond

14.124 Microeconomic Theory IV
Prereq: 14.123 and permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
Decision-making under uncertainty, information economics, incentive and contract theory. Class size limited.
B. Holmstrom

14.126 Game Theory
Prereq: 14.122
G (Spring)
3-0-9 H-LEVEL Grad Credit
Rigorous investigation of the evolutionary and epistemic foundations of solution concepts, such as rationalizability and Nash equilibrium. Covers classical topics, such as repeated games, bargaining, and supermodular games as well as new topics such as global games, heterogeneous priors, psychological games, and games without expected utility maximization. Applications provided when available.
M. Yildiz

14.128 Dynamic Optimization and Economic Applications
Prereq: 14.102
G (Spring)
2-0-4 H-LEVEL Grad Credit
I. Werner

14.129 Advanced Contract Theory
Prereq: 14.121, 14.281 or permission of instructors
G (Spring)
4-0-8 H-LEVEL Grad Credit
Recent developments in contract theory. Includes advanced models of moral hazard, adverse selection, mechanism design and incomplete contracts with applications to theory of the firm, organizational design, and financial structure.
M. Dewatripont

14.13 Economics and Psychology
Prereq: 14.03
U (Fall)
4-0-8 HASS
Introduction to theoretical and empirical literature in the new field of behavioral economics. Examines important and systematic departures from the predictions of the standard model in economics; covers intertemporal tradeoffs, risk preferences, social preferences, and intrinsic motivation; and applies theory to many different areas, such as credit card debt, addiction, portfolio choices, labor supply, and compensation policies of firms. Students review evidence from lab experiments, examine how the results can be integrated into models, and test models using field and lab data.
L. Goette

14.137 Psychology for Economists
Prereq: —
G (Spring)
4-0-8
Examines “psychology appreciation” for economics students. Aims to enhance knowledge and intuition about psychological processes in areas relevant to economics. Increases understanding of psychology as an experimental discipline, with its own distinct rules and style of argument. Topics include self-knowledge, cognitive dissonance, self-deception, emotions, social norms, self-control, learning, mental accounting, memory, individual and group behavior, and some personality and psycho-analytic models. Within each of these topics, we showcase effective and central experiments and discuss their role in the development of psychological theory. Term paper required.
D. Prelec

14.147 Topics in Game Theory
Prereq: 14.126
G (Fall)
4-0-8 H-LEVEL Grad Credit
Advanced subject on topics of current research interest.
M. Yildiz, Y. Sannikov

14.16 Strategy and Information
Prereq: 14.03 or 14.04
U (Spring)
4-0-8 HASS
Models of individual decision making. Topics in cooperative and non-cooperative game theory. Various applications ranging from voting and mechanism design to auctions and market microstructure models in finance.
S. Izmalkov

14.160 Experimental and Behavioral Economics
Prereq: 14.122
G (Fall)
4-0-8 H-LEVEL Grad Credit
Introduction to choice theory and the techniques of experimental economics and their applications. Covers behavioral implications of alternative choice-theoretic models. Teaches students how to design and run experiments. Topics covered may include subjective/Choquet expected utility; models of preference for flexibility and commitment; intertemporal choice; social preferences; competitive experimental markets; bargaining behavior; labor market experiments; cooperation and public good provision; principal-agent experiments and contract enforcement; nominal inertia and money illusion.
E. Fehr
14.191 Independent Research Paper
Prereq: Permission of instructor
G (Fall, Spring)
0-12-0 H-LEVEL Grad Credit
Can be repeated for credit
Under supervision of a faculty member approved by Graduate Registration Officer, student writes a substantial, probably publishable research paper. Must be completed by the end of a student’s second year to satisfy the departmental minor requirement.
P. Temin

Prereq: 14.121, 14.451
G (Fall)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Reading and discussion of special topics in economics. Open to advanced graduate students by arrangement with individual members of the staff. Consult Department Headquarters

14.195–14.196 Reading Seminar in Economics
Prereq: 14.121
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Reading and discussion of special topics in economics. Open to advanced graduate students by arrangement with individual members of the staff. Consult Department Headquarters

14.198–14.199 Teaching Introductory Economics
Prereq: —
G (Fall, Spring)
2-0-2 [P/D/F]
Can be repeated for credit
Required of teaching assistants in introductory economics (14.01 and 14.02), under supervision of the faculty member in charge of the subject.
14.198: W. Wheaton, J. Harris
14.199: P. Willen, F. Giavazzi

INDUSTRIAL ORGANIZATION

14.20 Industrial Organization and Competitive Strategy
Prereq: 14.01
U (Spring)
4-0-8 HASS
Analyzes the behavior and performance of firms in markets, with a particular focus on strategic interactions. Topics include monopoly power, behavior of firms in oligopoly markets, static and dynamic measurement of market performance, pricing and product choice decisions, advertising, research and development, and theory of the firm. Requires team participation in a competitive strategy game.
N. Rose

14.21J Health Economics
(Same subject as HST.901J)
Prereq: 14.01
U (Fall)
3-0-9 HASS
Applies theoretical and empirical tools of economics to problems of health and medical care delivery. Concentrates on selected problems such as the welfare economics of “health” as a commodity, hospitals and the nonprofit sector, human capital and medical manpower, and innovation in medicine.
J. E. Harris

14.271 Industrial Organization I
Prereq: 14.04
G (Fall)
4-0-8 H-LEVEL Grad Credit
Covers theoretical and empirical work dealing with the structure, behavior, and performance of firms and markets and core issues in antitrust. Topics include: the organization of the firm, monopoly, price discrimination, oligopoly, and auctions. Theoretical and empirical work are integrated in each area.
G. Ellison

14.272 Industrial Organization II
Prereq: 14.271
G (Spring)
4-0-8 H-LEVEL Grad Credit
A continuation of 14.271. Topics covered include horizontal mergers, vertical integration and vertical restraints, natural monopoly and its regulation, public enterprise, political economy of regulation, network access pricing, deregulation of telecommunications, electric power, cable television, and transportation sectors.
P. Joskow, N. Rose

14.273 Advanced Topics in Industrial Organization
Prereq: 14.271
G (Spring)
4-0-8 H-LEVEL Grad Credit
Introduction to current research in industrial organization, focusing on a specific set of issues that varies from year to year.
S. Ellison, P. Jia

14.281 Contract Economics
Prereq: 14.124
G (Fall)
4-0-8 H-LEVEL Grad Credit
Covers theoretical and empirical research on contracts. The presentation is organized around different types of models (agency, property rights, transaction costs, relational contracts), but with serious attention paid to applications and empirical studies of these models. Potential applications include executive compensation, insurance, transfer pricing, internal labor and capital markets, vertical and horizontal integration, alliances and joint ventures, entrepreneurship and liquidity demand.
R. Holden, B. Holmstrom

14.282 Organizational Economics
Prereq: 14.281
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8 H-LEVEL Grad Credit
Builds on the theory developed in 14.281, but focuses on substantive areas rather than on models per se. Topics include decision-making in organizations (power and politics, culture and leadership), organizational structures and processes (classic organizational forms and recent alternatives, capital allocation and transfer pricing), careers in organizations (incentives revisited, networks, new employment systems), contracts between organizations (joint ventures, alliances, networks), and organizations besides firms (order without law, government agencies).
Consult R. Gibbons

14.286J Health Economics Seminar
(Same subject as HST.903J)
Prereq: 14.04, permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Advanced subject in economics of health care sector. Considers selected topics in depth, such as design and financing of health insurance, behavior of nonprofit hospitals, role of competition in the medical care market, determinants of technological change, and effects of government regulations.
J. E. Harris
14.295j Collective Choice II
(Same subject as 17.886j)
Prereq: 17.884j or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 17.886j.
J. M. Snyder, Jr.

14.296j Collective Choice I
(Same subject as 17.884j)
Prereq: —
G (Fall)
3-0-9
See description under subject 17.884j.
J. M. Snyder, Jr.

STATISTICS AND ECONOMETRICS

14.30 Introduction to Statistical Method in Economics
Prereq: 18.02
U (Fall, Spring)
4-0-8 REST
Self-contained introduction to probability and statistics with some economic applications. Elements of probability theory, sampling theory, statistical estimation, and hypothesis testing. May not count toward HASS requirement. Consult Department Headquarters

14.32 Econometrics
Prereq: 14.30
U (Fall, Spring)
4-0-8
Introduction to econometric models and techniques, simultaneous equations, program evaluation, emphasizing regression. Advanced topics include instrumental variables, panel data methods, measurement error, and limited dependent variable models. Includes problem sets. May not count toward HASS requirement.
Fall: S. Ellison
Spring: W. Newey

14.33 Research and Communication in Economics: Topics, Methods, and Implementation
Prereq: 14.03 or 14.04; 14.05 or 14.06; 14.32
U (fall, Spring)
3-4-5 Institute LAB
Exposes students to the process of conducting independent research in empirical economics and effectively communicating the results of the research. Begins with an econometric analysis of an assigned economic question and culminates in each student choosing an original topic, performing appropriate analysis, and delivering oral and written project reports. Spring term is structured around a series of lectures and readings on several major substantive topics in experimental social science, such as race discrimination, gender differences in behavior, persuasion, and corruption. Lectures cover methodological topics that aid students in designing, conducting, analyzing, and presenting a field or laboratory experiment.
Fall: S. Ellison
Spring: D. Autor, E. Duflo

14.36 Advanced Econometrics (New)
Prereq: 14.30, 14.32
U (Spring)
4-0-8
Covers a range of topics including duration models, discrete choice models, differentiated product models, count models and other advanced models that are used in a wide variety of applications in applied microeconomics, financial economics, and business economics. Mastery of one or more techniques taught in class demonstrated through the completion of an econometrics paper.
J. Hausman

14.381 Statistical Method in Economics
Prereq: 18.02, permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Introduction to probability and statistics as background for advanced econometrics and introduction to the linear regression model. Elements of probability theory; sampling theory; asymptotic approximations; decision-theory approach to statistical estimation focusing on regression, hypothesis testing; and maximum-likelihood methods. Simple and multiple regression, estimation and hypothesis testing. Illustrations from economics and application of these concepts to economic problems. Class size limited.
V. Chernozhukov, A. Mikusheva

14.382 Econometrics
Prereq: 14.381 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Regression analysis, focusing on departures from the standard Gauss-Markov assumptions, and simultaneous equations. Regression topics include heteroskedasticity, serial correlation, and errors in variables, generalized least squares, nonlinear regression, and limited dependent variable models. Covers identification and estimation of linear and nonlinear simultaneous equations models. Economic applications are discussed. Class size limited.
J. Hausman

14.384 Time Series Analysis
Prereq: 14.382 or permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Theory and application of time series methods in econometrics, including representation theorems, decomposition theorems, prediction, spectral analysis, estimation with stationary and nonstationary processes, VARs, factor models, stochastic volatility, unit roots, and cointegration. Requires econometrics paper at the end of IAP. Class size limited.
A. Mikusheva

14.385 Nonlinear Econometric Analysis
Prereq: 14.382 or permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Micro-econometric models, including large sample theory for estimation and hypothesis testing, generalized method of moments, estimation of censored and truncated specifications, quantile regression, structural estimation, nonparametric and semiparametric estimation, panel data, bootstrapping, and simulation methods. Methods illustrated with economic applications. Requires econometrics paper at the end of IAP. Class size limited.
V. Chernozhukov, W. Newey

14.386 New Econometric Methods
Prereq: 14.382
G (Spring)
4-0-8 H-LEVEL Grad Credit
Focuses on recent developments in econometrics, especially structural estimation. Topics include nonseparable models, models of imperfect competition, auction models, duration models, and nonlinear panel data. Results illustrated with economic applications.
W. Newey

14.387 Topics in Applied Econometrics
Prereq: 14.382
G (Spring)
2-0-4 H-LEVEL Grad Credit
Covers topics in econometrics and empirical modelling that are likely to be useful to applied researchers working on cross-section and panel data applications.
J. Angrist
versus private health insurance, setting income
tax rates for individuals and corporations.

*J. Gruber*

**14.416J** Introduction to Financial Economics
(Same subject as 15.416J)
Prereq: 14.121, 14.122
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 15.416J.

*S. A. Ross*

**14.42 Environmental Policy and Economics**
(Subject meets with 14.420)
Prereq: 14.01; 14.30 or permission of instructor
U (Spring)
4-0-8 HASS

**14.420 Environmental Policy and Economics**
(Subject meets with 14.42)
Prereq: 14.01; 14.30 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
Explores the proper role of government in the
regulation of the environment. Explore the tools
necessary to estimate the costs and benefits of
environmental regulations to evaluate a series
of current policy questions, including: Should air
and water pollution regulations be tightened or
loosened? What are the costs of climate change
in the US and abroad? Is there a “race to the
bottom” in environmental regulation? Students
help design and execute a cutting edge research
project that tests whether air pollution causes
infant mortality. Graduate students are expected
to complete additional assignments.

*M. Greenstone*

14.44 Energy Economics and Policy
(Same subject as 14.44J)
Prereq: 14.03 or 14.04; 14.32
U (Spring)
4-0-8 HASS

Self-contained introduction to the theory of
investment decisions under uncertainty. Topics
include interest rates, net present value, fixed
income securities, the term structure of interest
rates, portfolio separation theorems, capital
asset pricing models, factor models, risk neutral
pricing, valuation of options, and intertemporal
consumption and investment models. Emphasis
on empirical implementation of theoretical
concepts.

*V. Chernozhukov*

14.451 Macroeconomic Theory I
Prereq: 14.06, permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
Introduction to the theories of economic growth.
Topics will include basic facts of economic
growth and long-run economic development; brief overview of optimal control theory and dynamic programming; basic neoclassical growth model under a variety of market structures; human capital and economic growth; endogenous growth models; models with endogenous technology; models of directed technical change; competition, market structure and growth; financial and economic development; international trade and economic growth; institutions and economic development. Half-term subject. Class size limited.

D. Acemoglu

14.452 Macroeconomic Theory II
Prereq: 14.451, permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

O. Blanchard

14.453 Macroeconomic Theory III
Prereq: 14.452, permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit

I. Werning

14.454 Macroeconomic Theory IV
Prereq: 14.453, permission of instructor
G (Fall)
2-0-4 H-LEVEL Grad Credit

R. Caballero

14.456 Topics in Macroeconomics
Prereq: 14.454
G (Fall)
Units arranged H-Level Grad Credit
Advanced subject on topics of current research interest in macroeconomics.

G. M. Angeletos

14.461 Advanced Macroeconomics I
Prereq: 14.122, 14.452
G (Fall)
4-0-8 H-LEVEL Grad Credit
First part focuses on monetary economics. Second part focuses on information and coordination problems: recent advances in global games; the impact of expectations about one another’s actions; welfare effects and policy implications; applications to financial crises (currency attacks, bank runs, etc.), monetary policy, and business cycles. Other topics may include recent work on incomplete markets, capital accumulation, and wealth inequality.

M. Angeletos, I. Werning

14.462 Advanced Macroeconomics II
Prereq: 14.461
G (Spring)
4-0-8 H-LEVEL Grad Credit

O. Blanchard, R. Caballero

14.463 Advanced Macroeconomics III
Prereq: 14.451
G (Fall)
4-0-8 H-LEVEL Grad Credit
Advanced topics of current interest in macroeconomics. 2007 focus: economic growth and long-run economic development. Exact set of topics adjusted according to the interests of the group.

D. Acemoglu

14.471 Public Economics I
Prereq: 14.04
G (Fall)
4-0-8 H-LEVEL Grad Credit
Theory and evidence on government taxation policy. Topics include tax incidence; optimal tax theory; the effect of taxation on labor supply and savings; taxation and corporate behavior; and tax expenditure policy.

J. Poterba, I. Werning

14.472 Public Economics II
Prereq: 14.471
G (Spring)
3-0-9 H-LEVEL Grad Credit
Theory and evidence on government expenditure policy. Topics include the theory of public goods; social insurance programs such as social security and unemployment insurance; health care policy; redistribution and the welfare state.

P. Diamond, J. Gruber

14.474 Advanced Topics in Public Economics
Prereq: 14.124
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
4-0-8 H-LEVEL Grad Credit
Introduction to current research in public economics, with a focus on the impact of taxation and government policy on household and firm behavior.

Consult J. Poterba

14.475 Environmental Economics and Government Responses to Market Failure
Prereq: 14.04
G (Spring)
4-0-8
Theory and evidence on regulatory, tax, and other government responses to problems of market failure. Special emphasis on developing and implementing tools to evaluate environmental policies. Topics include cost-benefit analysis, measurement of the benefits of non-market goods and costs of regulations, and the evaluation of the impact of regulations in areas such as financial markets, workplace health and safety, consumer product safety, and other contexts.

M. Greenstone

14.481 Economics of Education
(Subject meets with 11.126J)
(Subject meets with 11.249)
Prereq: 14.01
U (Spring)
4-0-8 HASS
See description under subject 11.126J.

F. Levy

14.49 Information Technology and the US Labor Market
(Subject meets with 11.128, 11.248)
Prereq: 14.01
Acad Year 2007–2008: Not offered
U (Spring)
4-0-8 HASS
Combines economic theory, econometric studies, workplace case studies, and other relevant literature to examine the impact of computerization and, more generally, information technology, on US employment and wages. Topics include: recent trends in wages and employment; estimates of the impact technological innovations have on labor demand; the relationship between rules-based logic and “high” and “low” skilled occupations; and the uses and limits of information technology in assisting students and workers to learn new skills.

F. Levy
INTERNATIONAL, INTERREGIONAL, AND URBAN ECONOMICS

14.54 International Trade
Prereq: 14.01, 14.02
U (Spring)
4-0-8 HASS

Introduction to the theory of international trade and finance with applications to current policy issues.
P. Antras

(Same subject as 1.283J, 11.410J, ESD.191J)
Prereq: 14.03 or 14.04
G (Spring)
3-0-9 H-LEVEL Grad Credit

The theory of urban land and housing markets, and the spatial development of cities. The roles played by transportation systems and local governments in shaping urban location patterns. Interregional competition, economic development, and the migration of labor and capital.
W. Wheaton

14.581 International Economics I
Prereq: 14.04
G (Spring)
4-0-8 H-LEVEL Grad Credit

Theory of international trade and foreign investment with applications in commercial policy.
K. Matsuyama

14.582 International Economics II
Prereq: 14.06
G (Fall)
4-0-8 H-LEVEL Grad Credit

International capital flows, exchange rate fluctuations, global capital markets, emerging markets, crises, sovereign debt, international financial architecture, and bubbles.
R. Caballero, R. Rigobon

LABOR ECONOMICS AND INDUSTRIAL RELATIONS

14.63 The American Labor Force in a Changing Economy
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4

Examines the role of technology, class, gender, race, and age through a historical discussion of important changes in the US economy over the last two centuries: the entrance of women into the paid labor force, the exit of older men out of paid labor, immigration, and the end of segregation.
R. Triest

14.66 Labor Economics and Public Policy
Prereq: 14.30; 14.03 recommended
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
4-0-8 HASS

Theory and evidence concerning the functioning of the labor market. Particular emphasis on the roles played by government and institutions. Topics include minimum wages, labor market effects of social insurance and welfare programs, the collective bargaining relationship, discrimination, human capital, and unemployment.
J. Angrist

14.661 Labor Economics I
Prereq: 14.04, 14.32
G (Fall)
4-0-8 H-LEVEL Grad Credit

Neoclassical analysis of the labor market and its institutions. A systematic development of the theory of labor supply, labor demand, and human capital. Topics discussed also include wage and employment determination, turnover, search, immigration, unemployment, equalizing differences, and institutions in the labor market. Particular emphasis on the interaction of theoretical and empirical modeling.
D. Acemoglu, J. Angrist

14.662 Labor Economics II
Prereq: 14.64 or 15.660
G (Spring)
4-0-8 H-LEVEL Grad Credit

The development and evolution of labor market structures and institutions. Particular focus on competing explanations of recent developments in the distribution of wage and salary income and in key institutions and organizational structures. Special attention to theories of worker motivation and behavior, the determination of wages, technology, and social stratification.
D. Autor, M. Piore

14.663 Advanced Topics in Labor Economics (New)
Prereq: 14.661
G (Spring)
4-0-8 H-LEVEL Grad Credit

Introduction to current research in labor economics, focusing on a specific set of issues that varies from year to year.
D. Autor, M. Greenstone

14.665J Labor Market Regulation and Career Mobility
(Same subject as 17.314J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 17.314J.
M. Piore

ECONOMIC HISTORY

14.70J Medieval Economic History in Comparative Perspective
(Same subject as 21H.416J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5

See description under subject 21H.416J.
A. McCants

14.71 Historical Perspectives on Current Economic Issues
Prereq: 14.01, 14.02
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Provides a historical perspective on the determinants and consequences of economic growth. Changes in population, education, technology, institutions, business organization, financial markets, labor markets, and government regulation are examined. Focus is primarily on the US.
Consult D. Costa

14.72 Capitalism and Its Critics
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 4

Addresses the evolution of the modern capitalist economy and evaluates its current structure and performance. Various paradigms of economics are contrasted and compared (neoclassical, Marxist, socioeconomic, and neocorporate) in order to understand how modern capitalism has been shaped and how it functions in today’s economy. Readings include classics in economic thought as well as contemporary analyses.
Stresses general analytic reasoning and problem formulation rather than specific analytic techniques. May not be used for economics concentration. One economics HASS-D subject may be used as an economics elective for the economics major and minor.
M. Piore
14.73 The Challenge of World Poverty (New)
Prereq: 14.01
Academic Year 2007–2008: Not offered
Academic Year 2008–2009: U (Fall)
4-0-8 HASS

Designed for students with some background in economics who are interested in the challenge posed by massive and persistent world poverty. Examines extreme poverty over time to see if it is no longer a threat, why some countries grow fast and others fall further behind, if growth or foreign aid help the poor, what we can do about corruption, if markets or NGOs should be left to deal with poverty, where to intervene, and how to deal with the disease burden and improve schools.

Consult A. Banerjee

14.731 Economic History
Prereq: 14.04, 14.06
G (Fall)
3-0-9 H-LEVEL Grad Credit

A survey of world economic history, designed to introduce economics graduate students to the subject matter and methodology of economic history. Topics chosen to show a wide variety of historical experience and illuminate the process of industrialization. Term paper due at the end of IAP.

P. Temin

ECONOMIC DEVELOPMENT

14.74 Foundations of Development Policy
Prereq: 14.01, 14.02, 14.30
U (Spring)
4-0-8 HASS

Explores the foundations of policy making in developing countries. Goal is to spell out various policy options and to quantify the trade-offs between them. Special emphasis on education, health, gender, fertility, adoption of technological innovation, and the markets for land, credit, and labor.

A. Banerjee, E. Duflo

Prereq: 14.121, 14.122
G (Fall)
4-0-8 H-LEVEL Grad Credit

Agricultural issues: peasant behavior, land tenancy, and interlinked markets. Credit and insurance market problems and institutions. Health, nutrition, and productivity. Gender bias.

Education. Technological change. Government failures.

A. Banerjee, E. Duflo

14.772 Development Economics: Macroeconomics
Prereq: 14.121, 14.451
G (Spring)
4-0-8 H-LEVEL Grad Credit

Dynamic models of growth and development emphasizing migration, modernization, and technological change; static and dynamic models of political economy; the dynamics of income distribution and institutional change; firm structure in developing countries; development, transparency, and functioning of financial markets; privatization; and banks and credit market institutions in emerging markets.

A. Banerjee, E. Duflo

14.773 Political Economy: Institutions and Development
Prereq: 14.121, 14.451
G (Spring)
4-0-8 H-LEVEL Grad Credit

Economists and policymakers increasingly realize the importance of political institutions in shaping economic performance, especially in the context of understanding economic development. Work on the determinants of economic policies and institutions is in its infancy, but is growing rapidly. Subject provides an introduction to this area. Topics covered: the economic role of institutions; the effects of social conflict and class conflict on economic development; political economic determinants of macro policies; political development; theories of income distribution and distributional conflict; the efficiency effects of distributional conflict; the causes and consequences of corruption; the role of colonial history; and others. Both theoretical and empirical approaches discussed. Subject can be taken either as part of the Development Economics or the Positive Political Economy fields.

D. Acemoglu, A. Banerjee

14.778J Economic Institutions and Growth Policy Analysis
(Same subject as 11.486J, 17.184J)
Prereq: 11.203
G (Spring)
3-0-6 H-LEVEL Grad Credit

See description under subject 11.486J.

A. Amsden, M. Piore

14.781J Political Economy I: Theories of the State and the Economy
(Same subject as 15.678J, 17.100J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 17.100J.

M. Piore, S. Berger

14.7h Graduate Thesis
Prereq: 14.33
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Staff

14.7hU Thesis
Prereq: 14.33
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Staff

14.UR Undergraduate Research
Prereq: 14.02
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

14.URG Undergraduate Research
Prereq: 14.02
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Participation in research with an individual faculty member or research group, independent research or study under the guidance of a faculty member. Admission by arrangement with individual faculty member.

Consult J. Gruber

2007–2008
MANAGERIAL ECONOMICS

15.002 Sloan Innovation Period Requirement
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Units assigned to MBA students upon completion of the Sloan Innovation Period leadership and research requirement. MBAs only.
T. Walor

15.010 Economic Analysis for Business Decisions
Prereq: 14.01
G (Fall)
4-0-5 H-LEVEL Grad Credit
15.011 Economic Analysis for Business Decisions
Prereq: 14.01
G (Fall)
4-0-5
Introduces students to principles of microeconomic analysis used in managerial decision-making. Topics include demand, cost and surplus analysis, the behavior of competitive and non-competitive markets, sources and uses of market power, and game theory and competitive strategy, with applications to various business and public policy decisions. Antitrust policy and other government regulations are also discussed. 15.010 restricted to first-year Sloan master’s students. 15.011 primarily for non-Sloan School students.
J. Doyle

15.012 Applied Macro- and International Economics
Prereq: —
G (Spring)
2-0-4
Case studies used to investigate the macroenvironment in which firms operate. First section develops the basic tools of macroeconomic management: monetary, fiscal, and exchange rate policy. Second section evaluates different strategies of economic development, with topics ranging from trade and industrial policy to reliance on natural resources. Third section discusses recent emerging market crises and examines the causes of these crises as well as how best to address them and prevent them from reoccurring in the future. Final section evaluates several major challenges currently faced by developed countries, such as global integration, inequality, and asset-price bubbles.
R. Rigobon, L. Thurow, T. Suri

15.013 Industrial Economics for Strategic Decisions
Prereq: 15.010 or 15.011
G (Fall)
3-0-9 H-LEVEL Grad Credit
Applies principles of industrial economics most relevant for corporate strategy to analysis of particular industries. Topics include market structure and its determinants; rational strategic behavior in small numbers situations; strategies for price and nonprice competition; dynamic pricing, output, and advertising decisions; entry and entry deterrence; network externalities, investments in real options, evolution of industries.
R. S. Pindyck

15.014 Applied Macro- and International Economics
Prereq: 15.012
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6
Uses case studies to investigate the macroeconomic and international environment in which firms operate. Evaluates the major economies around the world, how they differ, and what their prospects are for the future. Explores why governments adopt economic policies and how these policies affect companies’ ability to do business. Topics include monetary and fiscal policy, economic development strategies, the drivers of economic growth, natural resource dependency, exchange rate management, foreign aid, crises in emerging markets, financial contagion, the US trade deficit, unemployment in Europe, aging populations and insolvent entitlement programs, oil prices, outsourcing, globalization, and the emergence of China and India as major economic powers.
K. Forbes

15.015 Macro and International Economics
Prereq: —
G (Fall, Summer)
2-0-4
Focuses on the policy and economic environment of firms. Subject divided in three parts: study the closed economy and how monetary and fiscal policy interacts with employment, GNP, inflation, and interest rates; look at national economic strategies for development and growth, and study the recent financial and currency crises in emerging markets; study the problems faced by transition economies and the role of institutions both as the engine of growth, and as the constraints for policy. Half term course. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.
R. Rigobon

15.018 Management and Policy in the International Economy
Prereq: 15.012 or permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Examines major economic developments shaping the international business environment. Topics: causes and implications of exchange rate volatility, persistent imbalances in the US, integration in Europe, transition in Eastern Europe, growth in emerging economies, Asia’s international role, and regionalization.
K. Forbes, R. Rigobon

15.021 Real Estate Economics
(Same subject as 11.433J)
Prereq: 14.01, 15.010, or 15.011
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 11.433J.
W. C. Wheaton

15.023 Global Climate Change: Economics, Science, and Policy
(Same subject as 12.848J, ESD.128J)
Prereq: 18.02; 5.60 or 2.005; 15.010
G (Spring)
3-0-6 H-LEVEL Grad Credit
Introduces scientific, economic, and ecological issues underlying the threat of global climate change, and the institutions engaged in ne-

subjects 14.73 to 15.023J
15.024 Applied Economics for Managers
Prereq: —
G (Summer)
3-0-6
Develops facility with concepts, language, and analytical tools of economics. Primary focus on microeconomics, analysis of markets and strategic interactions among firms. Emphasizes integration of theory, data, and judgment in the analysis of corporate decisions, and in the assessment of the changing global business environment. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.

T. Stoker

15.025 Game Theory for Strategic Advantage
Prereq: 15.010
G (Spring)
3-0-6 H-LEVEL Grad Credit
Develops and applies principles of game theory relevant to managers’ strategic decisions. Topics include how to reason about strategies; “irrational” actions, reputation, and beliefs; entry deterrence; strategic substitutes and complements; brinkmanship and negotiation; and auctions. Applications to a variety of business decisions that arise in different industries.

D. McAdams

15.034 Applied Econometrics and Forecasting for Management
Prereq: —
G (Fall)
3-0-6
Designed for students interested in applied econometric methods and business forecasting as used in finance, strategy marketing and other business fields. Emphasizes modeling and problems typically encountered in conducting empirical analysis, in evaluating results and in constructing forecasts. Learning is primarily through empirical work done by student groups.

Staff

15.040 Special Seminar in Managerial Economics
Prereq: 15.010, 15.012
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Group study of current topics related to managerial economics not otherwise included in curriculum.

T. M. Stoker

OPERATIONS RESEARCH/STATISTICS

15.053 Optimization Methods in Management Science
Prereq: —
U (Spring)
4-0-8
Introduces students to the theory, algorithms, and applications of optimization. The optimization methodologies include linear programming, network optimization, integer programming, and decision trees. Applications to logistics, manufacturing, transportation, marketing, project management, and finance.

J. B. Orlin

15.054 The Airline Industry
(Same subject as 1.232J, 16.71J, ESD.217J)
Prereq: —
G (Fall)
3-0-9
See description under subject 16.71J.


15.057 Systems Optimization
Prereq: Permission of Instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Application-oriented introduction to systems optimization focusing on understanding system tradeoffs. Introduces modeling methodology (linear, network, integer, nonlinear programming, and heuristics), modeling tools (sensitivity and postoptimality analysis), software, and applications in production planning and scheduling, inventory planning, supply network optimization, project scheduling, telecommunications, facility sizing and capacity expansion, product development, yield management, electronic trading, and finance.

Consult R. M. Freund

15.060 Data, Models, and Decisions
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Introduces students to the basic tools in using data to make informed management decisions. Covers introductory probability, decision analysis, basic statistics, regression, simulation, linear and nonlinear optimization, and discrete optimization. Computer spreadsheet exercises, cases, and examples drawn from marketing, finance, operations management, and other management functions. Restricted to first-year Sloan master’s students.

D. Bertsimas, R. Freund, G. Perakis, A. S. Schulz

15.062 Data Mining: Finding the Data and Models that Create Value
Prereq: 15.060, 15.074, or 15.075
G (Spring)
2-0-4 H-LEVEL Grad Credit
Introduces students to a class of methods known as data mining or machine learning that assist managers in recognizing patterns and making intelligent use of massive amounts of electronic data collected via the internet, e-commerce, electronic banking, point-of-sale devices, barcode readers, and intelligent machines. Topics selected from logistic regression; association rules; tree-structured classification and regression; cluster analysis; discriminant analysis; and neural network methods. Examples of successful applications in areas such as credit ratings, fraud detection, database marketing, customer relationship management, investments, and logistics are covered. Introduction to data-mining software. Half-term subject.

R. Welsch

15.063 Communicating with Data
Prereq: —
G (Summer)
3-0-6
Introduces statistical tools and communication skills for using data to influence management decisions. In real-life decisions, decision makers use both analytical and intuitive approaches to understand problems and to persuade others to act. Statistical tools are important, but statistical arguments are often met with skepticism. Subject covers behavioral decision theory, communication principles, probability, decision analysis, statistics, and regression, with exercises and examples drawn from marketing, finance, operations management, strategy and negotiations. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.

A. Barnett
15.064 | Engineering Probability and Statistics  
(Same subject as ESD.751J)  
Prereq: 18.02  
G (Summer)  
4-0-8 H-LEVEL Grad Credit  
Modeling and analysis of uncertainty and variation. Probability models and distributions, regression, and basic statistical procedures pertinent to manufacturing. Introduction to experimental design, Taguchi methods, and statistical process control. Use of a data analysis package such as JMP or Minitab. Primarily for Leaders for Manufacturing students.  
A. I. Barnett, R. Welsch

15.065 | Decision Analysis  
Prereq: 15.060 or 6.041  
G (Spring)  
5-0-1 H-LEVEL Grad Credit  
 Begins with development of tools for decision-making under uncertainty: construction and analysis of decision trees and influence diagrams using decision analysis software; quantification of judgments; risk preferences; and degree of risk aversion via subjective expected utility. Generalizations of expected utility theory to problems in which consequences are descriptively complex and multi-attributed are illustrated with applications in engineering and management. The real options approach to strategic choice is treated as a logical extension of decision analysis that employs financial market information to determine and value optimal strategies when managers can flexibly adapt to an unfolding, uncertain future. Methods for integrating decision analysis and option pricing using financial market information are illustrated with applications to a wide variety of cases, such as valuing start-ups, valuing manufacturing flexibility, valuing new technologies, valuing oil and gas exploration, and development options. A project report is required in place of a final exam. Half-term subject.  
G. M. Kaufman

15.066 | System Optimization and Analysis for Manufacturing  
(Same subject as 2.851J, ESD.750J)  
Prereq: 18.02  
G (Summer)  
4-0-8 H-LEVEL Grad Credit  
Introduction to mathematical modeling, optimization, and simulation, as applied to manufacturing. Specific methods include linear programming, network flow problems, integer and nonlinear programming, discrete-event simulation, heuristics and computer applications for manufacturing processes and systems. Restricted to Leaders for Manufacturing students.  
S. C. Graves, J. P. Clark, J. Gallien

15.067 | Competitive Decision-Making and Negotiation  
Prereq: —  
G (Fall, Spring)  
3-0-3  
Learn tools to achieve negotiation objectives fairly and responsibly. Negotiation skills developed by active participation in a variety of negotiation settings: an oil price (repetitive Prisoners’ Dilemma) negotiation; fair division of a valuable art collection and a series of integrative bargaining cases between two and more than two parties over multiple issues; e.g. owners of an online vendor of mid-priced wines negotiates sale of the company to a large chain; two companies negotiate an IT deal. Several complex team negotiations follow. Grades depend solely on effective negotiation with class counterparts. Students must complete all negotiation exercises in order to receive a grade. Half term subject.  
G. M. Kaufman

15.068 | Statistical Consulting  
Prereq: 15.060  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
2-0-4 H-LEVEL Grad Credit  
Addresses statistical issues as a consultant would face them: deciphering the client’s question; finding appropriate data; performing a viable analysis; and presenting the results in compelling ways. Real-life cases and examples.  
A. I. Barnett

15.070 | Advanced Stochastic Processes  
Prereq: 6.431, 6.436J/18.085J, or 18.100 G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Analysis and modeling of stochastic processes. Topics include measure theoretic probability, martingales, filtration, and stopping theorems; elements of large deviations theory; Brownian motion and reflected Brownian motion; stochastic integration and Ito calculus; functional limit theorems. Applications to finance theory, insurance, queueing and inventory models. Alternate years.  
D. Gamarnik, D. J. Bertsimas

15.071 | Decision Methodologies for Managers  
Prereq: 15.060  
G (Spring)  
3-0-6 H-LEVEL Grad Credit  
Follows 15.060, covering more advanced material in both statistics and optimization. Applied emphasis. Team projects. Introduction to statistical consulting, which presents major challenges beyond the proper use of statistical methods. Restricted to Sloan master’s students.  
A. I. Barnett

15.072 | Queues: Theory and Applications  
(Same subject as 6.264J)  
Prereq: 6.262  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Modeling and analysis of queueing systems, with applications in communications, manufacturing, computers, call centers, service industries and transportation. Topics include birth-death processes and simple Markovian queues, networks of queues and product form networks, single and multi-server queues, multi-class queueing networks, fluid models, adversarial queueing networks, heavy-traffic theory and diffusion approximations. Covers state of the art results which lead to research opportunities.  
D. Bertsimas, D. Gamarnik, J. N. Tsitsiklis

15.073 | Logistical and Transportation Planning Methods  
(Same subject as 1.203J, 6.281J, 16.76 J, ESD.216J)  
Prereq: 6.431  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 1.203J.  
R. C. Larson, A. R. Odoni, A. I. Barnett

15.074 | Statistical Reasoning and Data Modeling (New)  
(Same subject as ESD.755J)  
Prereq: Permission of instructor  
G (Fall)  
4-0-8 H-LEVEL Grad Credit  
Designed for students who have an acquaintance with statistics and want exposure to a wider range of topics and examples such as statistical computing and data analysis. Topics include advanced regression modeling: regression diagnostics, variable selection, and robust regression. Design of experiments and analysis of variance. Introduction to data-mining includes stratified sampling, classification, logistic regression, and clustering; time series analysis and forecasting; process control; and Bayesian methods. Use of statistical computing systems
15.075 Statistical Thinking and Data Analysis
Prereq: 6.041 or 18.440; 18.06 U (Fall) 4-0-8
Introduces statistical data analysis, concentrating on techniques used in management science and finance. Topics chosen from statistical graphics; sampling; estimation; hypothesis testing; linear and logistic regression; analysis of variance; categorical data analysis; and classification. SAS, S+ or similar statistics package used for computing.
A. I. Barnett

15.081 j Introduction to Mathematical Programming
(Same subject as 6.855), ESD.78J)
Prereq: 6.046J, 6.251J, 15.081J, or permission of instructor
Acad Year 2007–2008: Not offered Acad Year 2008–2009: G (Spring) 3-0-9 H-LEVEL Grad Credit
In-depth treatment of the modern theory of integer programming and combinatorial optimization, emphasizing geometry, duality and algorithms. Topics include formulating problems in integer variables, enhancement of formulations, ideal formulations, integer programming duality, linear and semidefinite relaxations, lattices and their applications, the geometry of integer programming, primal methods, cutting plane methods, connections with algebraic geometry, computational complexity, approximation algorithms, heuristic and enumerative algorithms, mixed integer programming and solutions of large scale problems. Alternate years.
A. S. Schulz

15.082 j Network Optimization
(Same subject as 6.856J, ESD.78J)
Prereq: 6.046J, 6.251J, 15.081J, or permission of instructor
Acad Year 2007–2008: Not offered Acad Year 2008–2009: 3-0-9 H-LEVEL Grad Credit
Network models for industrial logistics systems, transportation systems, communication systems, and other applications. Emphasizes a rigorous treatment of algorithms and their efficiency—algorithms for shortest routes, maximum flows, minimum cost flows, traffic equilibrium, and network design. Implementation issues.
A. S. Schulz

15.083 J Integer Programming and Combinatorial Optimization
(Same subject as 6.859J)
Prereq: 15.081J or permission of instructor
Acad Year 2007–2008: G (Fall) Acad Year 2008–2009: Not offered 3-0-9 H-LEVEL Grad Credit
In-depth treatment of the modern theory of integer programming and combinatorial optimization, emphasizing geometry, duality and algorithms. Topics include formulating problems in integer variables, enhancement of formulations, ideal formulations, integer programming duality, linear and semidefinite relaxations, lattices and their applications, the geometry of integer programming, primal methods, cutting plane methods, connections with algebraic geometry, computational complexity, approximation algorithms, heuristic and enumerative algorithms, mixed integer programming and solutions of large scale problems. Alternate years.
D. J. Bertsimas, A. S. Schulz

15.084 J Nonlinear Programming
(Same subject as 6.252J)
Prereq: 18.06, 18.100 G (Spring) 3-0-9 H-LEVEL Grad Credit
See description under subject 6.252J.
R. M. Freund, D. P. Bertsekas, G. Perakis

15.085 J Fundamentals of Probability
(Same subject as 6.436J)
Prereq: 18.02 G (Fall) 4-0-8 H-LEVEL Grad Credit
See description under subject 6.436J.
J. N. Tsitsiklis, D. Bertsimas

15.086 J Optimization Methods
(Same subject as 6.255J)
Prereq: 18.06 G (Fall) 4-0-8 H-LEVEL Grad Credit
Introduces the principal algorithms for linear, network, discrete, nonlinear, dynamic optimization and optimal control. Emphasis on methodology and the underlying mathematical structures. Topics include the simplex method, network flow methods, branch and bound and cutting plane methods for discrete optimization, optimality conditions for nonlinear optimization, interior point methods for convex optimization, Newton’s method, heuristic methods, and dynamic programming and optimal control methods.
D. Bertsimas, P. Parrilo

15.093 J Optimization Methods
(Same subject as 6.253J)
Prereq: 6.041 or 18.440; 18.06 or 18.700 G (Spring) 4-0-8 H-LEVEL Grad Credit
Introduction to the theory and application of statistics and data mining, concentrating on techniques used in management science, finance, engineering systems, and bioinformatics. First half builds the statistical foundation for the second half which concentrates on data-mining, supervised learning, and multivariate analysis. First half topics selected from sampling; theory of estimation; testing; nonparametric statistics; analysis of variance; categorical data analysis; regression analysis; MCMC; EM; Gibbs sampling; hidden Markov models; and Bayesian methods. Second half topics selected from logistic regression; principal components and dimension reduction; discrimination and classification analysis and trees; partial least squares; dimension reduction; discrimination and classification analysis; regression analysis; MCMC; EM; Gibbs sampling; hidden Markov models; and Bayesian methods. SAS, S+ or similar statistics package used for computing.
R. E. Welsch

15.094 J Systems Optimization: Models and Computation
(Same subject as 1.142J)
Prereq: 15.093 or 15.081J/6.251J G (Spring) 4-0-8 H-LEVEL Grad Credit
A computational and application-oriented introduction to the modeling of large-scale systems in a wide variety of decision-making domains and the optimization of such systems using state-of-the-art optimization software. Application domains include transportation and logistics, pattern classification, structural design, financial engineering, and telecommunications system planning. Modeling tools and techniques covered include linear, network, discrete, and nonlinear programming, heuristic methods, sensitivity and postoptimality analysis, decomposition methods for large-scale systems, and stochastic programming.
R. M. Freund

15.095 Special Seminar in OR/Statistics
Prereq: Permission of instructor G (Fall, Spring) Units arranged H-LEVEL Grad Credit
Group study of current topics related to operations research/statistics not otherwise included in curriculum.
J. B. Orlin

15.098 Special Seminar in Applied Probability and Stochastic Processes
Prereq: 6.431 G (Spring) 2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Doctoral student seminar covering current topics in applied probability and stochastic processes.
D. Gamarnik, D. Shah
15.099 Special Seminar in Operations Research
Prereq: 15.081
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Doctoral student seminar covering current topics related to operations research not otherwise included in the curriculum.

D. Bertsimas, R. Freund, T.L. Magnanti, J.B. Orlin, G. Perakis, A. S. Schulz

Civil and Environmental Engineering: 1.151, 1.155, 1.201, 1.203, 1.205, and 1.732

Electrical Engineering and Computer Science: 6.041, 6.231, 6.245, 6.262, 6.431, 6.432, and 6.435

Management: 15.034, 15.061, 15.065, 15.070, 15.075, 15.076, 15.098, and 15.306

Mathematics: 18.05, 18.175, 18.177, 18.440, 18.441, 18.443, 18.445, 18.446, 18.458, and 18.465

See also: 2.061, 2.830, 2.870, 5.70, 5.72, 7.02, 8.044, 8.08, 10.816, 11.220, 11.221, 16.322, 17.842, 17.846, 22.38, HST.191, and MAS.622.

HEALTH CARE MANAGEMENT

15.121] Clinical Trials in Biomedical Enterprise
(Same subject as HST.975)
Prereq: —
G (Fall)
2-0-4

See description under subject HST.975).

H. Golub

15.122] Critical Reading and Technical Assessment of Biomedical Information
(Same subject as HST.977)
Prereq: SB degree in Biological Science or permission of instructor
G (Spring)
1-0-2 H-LEVEL Grad Credit

See description under subject HST.977).

S. Lapidus, S. Sengupta

15.123] Dynamics of Biomedical Technologies
(Same subject as HST.979)
Prereq: —
G (Fall, Spring)
2-0-1 [P/D/F]
Can be repeated for credit

See description under subject HST.979).

A. J. Sinsky, F. Douglas, T. Dagi

15.124] Evaluating a Biomedical Business Concept
(Same subject as HST.973)
Prereq: HST.971
G (Spring)
1-0-2 H-LEVEL Grad Credit

See description under subject HST.973).

R. J. Cohen, T. Dagi, C. Berke, E. Cannon

15.126] The Legal Framework of Biomedical Enterprise
(Same subject as HST.932)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-3

See description under subject HST.932).

J. Akula

15.136] Principles and Practice of Drug Development
(Same subject as 7.547, 10.547, HST.920)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Description and critical assessment of the major issues and stages of developing a pharmaceutical or biopharmaceutical. Drug discovery, preclinical development, clinical investigation, manufacturing and regulatory issues considered for small and large molecules. Economic and financial considerations of the drug development process. Multidisciplinary perspective from faculty in clinical; life; and management sciences; as well as industry guests.

T. J. Allen, C. L. Cooney, S. N. Finkelstein, R. H. Rubin, A. J. Sinsky

15.137] Case Studies and Strategies in Drug Discovery and Development (New)
(Same subject as 7.549, 20.486)
Prereq: Permission of Instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 20.486).


15.141] Economics of the Health Care Industries
(Same subject as HST.918)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

Focuses on economic issues in various health care industries, such as the pharmaceutical, biotech and medical device industries. Differences between health care and other industries, regulatory issues involving establishing efficacy and cost-effectiveness of treatments, strategic issues in global marketing and pricing, use of e-commerce and information technology, and formation and management of various alliances, are addressed. Visiting speakers come from academia, government and industry.

E. R. Berndt

GLOBAL ECONOMICS & MANAGEMENT

15.220 Global Strategy and Organization
Prereq: Permission of Instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

Focuses on the international dimensions of strategy and organization, and provides a framework for formulating strategies in an increasingly complex world economy, and for making those strategies work effectively. Topics include the globalization of industries, the continuing role of country factors in competition, organization of multinational enterprises, building global networks, and the changing managerial tasks under conditions of globalization. There is no prerequisite but 15.012 and 15.223 are highly recommended. Half-term subject.

D. Lessard

15.223 Global Markets, National Policies and the Competitive Advantages of Firms
Prereq: Permission of Instructor
G (Fall, Spring, Summer)
3-0-3 H-LEVEL Grad Credit

Examines opportunities and risks firms face in today’s global market. Provides conceptual tools for analyzing how governments and social institutions influence economic competition among firms embedded in different national settings. Public policies and institutions that shape competitive outcomes are examined through cases and analytical readings on different companies and industries operating in both developed and emerging markets. Undergraduates may register for this subject provided they are ready to participate with the intensity expected for a grad H-level subject. There is no prerequisite but 15.012 is highly recommended. Half-term subject.

R. M. Locke, Y. Huang

MANAGEMENT

subjects 15.075 to 15.223
15.225 Economy and Business in Modern China and India (New)  
Prereq: —  
G (Spring)  
3-0-3

As markets or production bases, China and India are becoming important and integral players in the global economy. Foreign direct investment (FDI), portfolio investments and outsourcing businesses have increased dramatically in these two economies. Despite the rising importance of these two economies on the world stage, our knowledge and analysis of these two countries, in an integrated manner, has remained poor. The two are often lumped together by business analysts as emerging markets, despite the substantial differences in their political systems, reform policies and business organizations. Academics, in contrast, have tended to treat two countries separately, preferring to specialize in issues and questions specific to one or the other country. The purpose of this course is to analyze these two countries within a coherent analytical framework. Our learning model is inductive, and heavily based on class discussions and participation. The group projects should aim at integrating analysis, knowledge and understanding of these two countries. We will also experiment with other forms of group projects, such as creating and working on business plans and those projects that integrate research from field trips with more traditional research (such as library research). There is no prerequisite but 15.012 and 15.223 are highly recommended. Half term course.

Y. Huang

15.227–229 Special Seminars in International Management  
Prereq: —  
G (Fall, Spring)  
Units arranged  
Can be repeated for credit

Group study of current topics related to international business not otherwise included in curriculum. Consult Y. Huang

15.249 Special Seminar in International Management  
Prereq: 15.341, 15.342  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit

An advanced seminar in the evolution and key analytical frameworks of the field of international management, covering the major theoretical work and approaches to empirical research in the field and linking these to the core frameworks of strategy and organization theory. Restricted to doctoral students. Alternate years.

D. E. Westney

COMMUNICATION

15.277 Special Seminar in Communications  
Prereq: —  
G (Fall, Spring)  
Units arranged  
Can be repeated for credit

15.278 Special Seminar in Communications  
Prereq: —  
G (Fall, Spring)  
Units arranged [P/D/F]  
Can be repeated for credit

Group study of current topics related to communication not otherwise included in curriculum.

J. Yates

15.279 Management Communication for Undergraduates  
Prereq: —  
U (Fall, Spring)  
3-0-9

Required seminar for Management Science majors to develop the writing, speaking, teamwork, and interpersonal communication skills necessary for managers. Students learn communication principles, strategies, and methods through discussions, exercises, examples, and cases. Assignments include writing memos and business letters, and giving oral presentations in labs outside of class. A major project is the production of a team report and presentation on a topic of interest to a managerial audience. Priority given to Course 15 students.

L. Breslow

15.280 Communication for Managers  
Prereq: Permission of instructor  
G (Fall)  
2-0-4 H-LEVEL Grad Credit

Writing and speaking skills necessary for a career in management. Students polish communication strategies and methods through discussion, examples, and practice. Several written and oral assignments, most based on material from other subjects and from career development activities. Schedule and curriculum coordinated with Organizational Processes class. Restricted to first-year Sloan School of Management graduate students.

L. Hafrey, N. Hartman, T. Heagney, C. Kelly, R. Piltore
15.281 Advanced Managerial Communication  
Prereq: 15.279, 15.280, or permission of instructor  
G (Spring)  
3-0-6 H-LEVEL Grad Credit  
Builds on managerial communication skills developed in 15.279 or 15.280. Introduces interactive oral and interpersonal communication skills important to managers, including presenting to a hostile audience, running meetings, listening, and contributing to group decision-making. Includes team-run classes on chosen communication topics. Also includes an executive summary and a long oral presentation, both aimed at a business audience, generally in conjunction with a project for another subject.  
N. Hartman

15.289 Doctoral Seminar: Communication Skills for Academics  
Prereq: Permission of instructor  
G (Spring)  
3-0-3 H-LEVEL Grad Credit  
Focuses on the communication skills needed for a career in academia. Topics include writing for academic journals, preparing and delivering conference papers and job talks, peer reviewing for journals and conferences, and teaching. Participants are expected to work on a written project and deliver an oral presentation based on their current research. Restricted to doctoral students who have completed their first year. Limited to 20 students. Priority to Sloan students.  
J. Yates, L. Breslow

ORGANIZATION STUDIES

15.301 Managerial Psychology Laboratory  
Prereq: —  
U (Fall, Spring)  
3-3-9 Institute LAB  
Core subject for students majoring in management science. Surveys individual and social psychology and organization theory interpreted in the context of the managerial environment. Laboratory involves projects of an applied nature in behavioral science. Emphasizes use of behavioral science research methods to test hypotheses concerning decision-making, group behavior and organizational behavior. Instruction and practice in communication include report writing, team projects, and oral and visual presentation. 12 units may be applied to the General Institute Laboratory Requirement.  
J. Carroll, D. Ariely

15.305 Leadership and Management  
Prereq: Permission of instructor  
U (Fall)  
3-0-6  
Explores leadership from the military perspective taught by professors of military science from the Army, Navy and Air Force. Survey of basic principles for successfully managing and leading people, particularly in public service and the military. Develops skills in topics such as oral and written communication techniques, planning, team building, motivation, ethics, decision-making, and managing change. Relies heavily on interactive experiential classes with case studies, student presentations, role plays, and discussion. Also appropriate for non-management science majors.  
B. Baker, D. Ancona

15.309 Organizational Processes  
Prereq: —  
G (Fall, IAP)  
4-0-8  
Focuses on the organization of the future, identifies its characteristics, and explores the implications for living in, managing, and leading such an organization. Also focuses on skills such as organizational diagnosis, teamwork, and process analysis. Examines the creation of the structures, rewards, career paths, and cultures needed within the firm, and the alliances, learning, and change practices needed to maintain global performance. Restricted to first year LFM students and students in the SDM program.  
P. Carlile, T. A. Kochan

15.311 Organizational Processes  
Prereq: Permission of instructor  
G (Fall)  
2-0-4 H-LEVEL Grad Credit  
Enhances students' ability to take effective action in complex organizational settings by providing the analytic tools needed to analyze, manage, and lead the organizations of the future. Emphasizes the importance of the organizational context in influencing which individual styles and skills are effective. Employs a wide variety of learning tools, from experiential learning to the more conventional discussion of written cases. Centers on three complementary perspectives on organizations: the strategic design, political, and cultural "lenses" on organizations. Restricted to first-year Sloan master's students.  
R. Fernandez, P. J. Boczkowski, J. Van Maanen

15.315 Planning and Managing Change  
Prereq: One subject in organizational psychology and permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall, Spring)  
3-0-6 H-LEVEL Grad Credit  
Basic models and tools used to analyze any change problem in human systems. Application of these models and tools to actual change projects chosen by members of the class, to be completed during the course. Group as well as individual projects, and weekly papers on progress. Models and tools drawn from organization development theory. Primarily for master's students and Sloan Fellows. Enrollment is limited to 35 students.  
J. Van Maanen

15.316 Building and Leading Effective Teams  
Prereq: —  
G (Summer)  
2-1-0 [P/D/F]  
An intensive one-week introduction to leadership, teams, and learning communities. Introduction of concepts and use of a variety of experiential exercises to develop individual and team skills and develop supportive relationships within the Fellows class. Restricted to first year LFM Fellows.  
Consult J. S. Carroll

15.317 Organizational Leadership and Change  
Prereq: —  
G (Fall, IAP, Spring, Summer)  
Units arranged  
Can be repeated for credit  
Affords a structured debriefing of the LFM internship experience with a focus on improving
students' leadership and organizational change skills. Examines leadership and its role in the change process. Students learn more about themselves as leaders, the concept of leadership from various theoretical perspectives, and leadership in today's organizations. Includes lectures, discussions, debates, guest speakers, and experiential exercises. Grades are based on multiple short deliverables throughout the term and a leadership paper based on the internship experience.

T. A. Kochan, J. Klein

15.318 Leadership and Change in Organizations
Prereq: 15.311, 15.315, 15.322, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit

Leadership theory, leadership skills, and self-reflection. Focuses on three questions: What is leadership? What kind of leader am I? How can I develop as a leader? Built around the 3 C's Sloan Leadership Model: catalyzing action, contingent on context, and change signature. Leadership is about making things happen, creating change, with a deep understanding of the context and who you are as an individual. Aims to increase knowledge and skills related to catalyzing action, including how to make sense of context, using power and influence, building momentum for change, creating a visionary speech, and developing leadership capabilities in others. Includes a number of self-assessment exercises examining personal history, emotional intelligence, and catalyzing action skills to help identify personal change signature. Half-term subject.

D. G. Ancona

15.320 Strategic Organizational Design (New)
Prereq: —
G (Spring)
3-0-6

Focuses on designing effective organizations, with emphasis on innovative organizational forms that can provide strategic advantage. Topics include creating new organizational possibilities with IT, democratic decision-making, prediction markets, internal and external resource markets, collective intelligence, and organizational invention techniques. Team projects include inventing new possibilities for real organizations.

T. Malone

15.322 Leading Organizations
Prereq: —
G (Fall, Summer)
4-0-5 [P/D/F]

Analyzes through lectures, discussions, and class exercises, the human processes underlying organizational behavior. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.

J. Van Maanen

15.325 Seminar in Leadership I
Prereq: —
G (Fall)
2-0-1 [P/D/F]

Provides students opportunities to meet senior executives of private and public institutions, and discuss key management issues from the perspective of top management. Students prepare detailed briefings identifying and analyzing important management issues facing these organizations. Seminar includes a one week field trip to a domestic location. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.

Consult S. Sacca

15.326 Seminar in Leadership II
Prereq: 15.325
G (Spring)
2-0-1 [P/D/F]

Continuation of subject 15.325 on the identification and analysis of important management issues. Students prepare briefings and meet with senior government and international leaders during field trips in selected international areas. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.

S. Sacca

15.328–15.329 Special Seminar in Organization Studies
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Group study of current topics related to organization studies not otherwise included in curriculum.

Consult D. G. Ancona

15.341 Individuals, Groups, and Organizations
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit

Develops basic concepts for understanding individual, group, and organizational behavior through critical analysis of important works in the field. Areas covered: individual affect and cognition; group process and performance; and organizational culture and adaptation. Emphasizes use of behavioral science concepts for stimulating new and useful organizational behavior research. Primarily for doctoral candidates in the Sloan School of Management.

J. Carroll

15.342 Organizations and Environments
(Same subject as 11.262)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Provides an introduction to research in “organizations and environments,” an interdisciplinary domain of inquiry drawing primarily from sociology, and secondarily from economics, psychology, and political science. Seeks to understand organizational processes and outcomes in the surrounding economic, cultural, and institutional context in which they are situated. Also introduces the main groups that together form the Behavioral Policy Sciences (BPS) area of MIT/Sloan. In addition to Economic Sociology, these groups are Organization Studies, Work and Employment, Strategic Management, Global Management, and Technology, Innovation, and Entrepreneurship. Primarily for first-year doctoral students in BPS. Subject consists of four modules that are taught by faculty from each of the four BPS groups, as well as integrative sessions taught by the main instructor.

E. Zuckerman

15.345 Doctoral Seminar in Behavioral and Policy Sciences
Prereq: Permission of instructor
G (Fall)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

A professional seminar for doctoral students to report on their research, work on their thesis proposals, and practice their job talks. Also addresses general professional issues such as publishing, searching for jobs, the academic career, etc.

L. Bailyn

15.347 Doctoral Seminar in Research Methods I
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Introduces the process of social research, emphasizing the conceptualization of research choices to ensure validity, relevance, and discovery. Includes research design and techniques of
data collection as well as issues in the understanding, analysis, and interpretation of data. S. Silbey

**15.348 Doctoral Seminar in Research Methods**
Prereq: 15.347 or permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Builds on 15.347 to examine contemporary social research methods in depth. Focuses on making students familiar with the most important quantitative methods (e.g., logit/probit models, count models, event history models) or qualitative methods (e.g., ethnography, interviewing, participant observation).
E. J. Castilla

**15.349 Qualitative Research Methods**
(Same subject as 21A.760J, STS.401J)
Prereq: —
G (Spring)
3-6-3
See description under subject 21A.760J.
S. Silbey

**TECHNOLOGY, INNOVATION AND ENTREPRENEURSHIP**

**15.350 Managing Technological Innovation and Entrepreneurship**
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Focuses on the challenges inherent in attempting to take advantage of both incremental innovation and more radical or breakthrough changes in products, processes and services. Highlights the importance of innovation to both new ventures and to large established firms and explores the organizational, economic and strategic problems that must be tackled to ensure innovation is a long term source of competitive advantage. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.
M. A. Cusumano, A. d’Arbeloff, E. B. Roberts

**15.351 Managing Innovation and Entrepreneurship**
Prereq: —
G (Fall, Spring)
3-0-6
The basics every manager needs to organize successful technology-driven innovation in both entrepreneurial and established firms. This is not a subject in innovation strategy. Instead it examines how to build organizations that excel at identifying, building and commercializing technological innovations. Major topics include how the innovation process works; creating an organizational environment that rewards innovation and entrepreneurship; building successful innovative teams; designing appropriate innovation processes (e.g. stage-gate, portfolio management); organizing to take advantage of internal and external sources of innovation; and structuring entrepreneurial and established organizations for effective innovation. Examine how entrepreneurs can shape their firms so that they continuously build and commercialize valuable innovations. Many of the examples also focus on how established firms can become more entrepreneurial in their approach to innovation.
F. Murray

**15.352 Innovation in the Internet Age: Emerging Trends**
Prereq: —
G (Spring)
3-0-3
Important emerging trends in innovation are identified and their implications for innovation management explored. Major topics include the trend to open information (open source) rather than protected intellectual property; distribution of innovation over many independent and collaborating actors; and toolkits that empower users to innovate for themselves. Half-term subject.
E. A. von Hippel

**15.353 Research Themes in Management of Technology**
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Successful origination, development, implementation, and diffusion of product and process innovations in industry. Effective organization and management of the technological change process (marketing, R&D, engineering, and manufacturing) in new ventures, multidivisional and multinational enterprises. Current research topics of MIT faculty. Thesis research models and methods.
J. M. Utterback

**15.354 Innovation and Entrepreneurship: How to Do It**
Prereq: —
U (Spring)
3-0-6
Examines how to be a successful innovator in a big company and how to be an entrepreneur. Covers both internet-age and traditional businesses. Research findings are combined with practical advice from experienced innovators to help launch students on a successful innovation trajectory. Lecture-based course. Periodic, short projects enable students to explore topics of special interest to them independently or in small groups.
J. M. Utterback

**15.356 How to Develop Breakthrough Products and Services**
Prereq: —
G (Spring)
3-0-3
Firms must develop major innovations to prosper but they don’t know how. Recent research into the innovation process has made it possible to develop breakthroughs systematically. Explore several practical idea generation development methods. Presentations of real cases by invited experts conveys the art required to implement each. Half-term subject.
E. A. von Hippel

**15.358 The Software Business**
Prereq: —
G (Fall)
3-0-6
Seminar-style subject for people interested in founding or growing an enterprise or consumer software company (products, services or both), or working as a software company manager, product or program manager, or industry analyst. Examine approaches used for organization and product development at successful companies ranging from Microsoft, IBM, Siebel/Oracle, and SAP to Google, Web 2.0, and other new companies. History of software as a business as well as key trends in different software markets. Student-teams help teach weekly sessions and analyze emerging companies and sectors in team projects.
M. A. Cusumano

**15.360 Introduction to Technological Entrepreneurship (New)**
Prereq: Permission of instructor
G (Fall)
2-0-1 H-LEVEL Grad Credit
Overview of the field of entrepreneurial theory and practice for development and growth of technology-based new enterprises. Introduction to the MIT ecosystem of entrepreneurship. Weekly lectures by academic and practitioner faculty engaged in the MIT Entrepreneurship Program, supplemented by presentations by and discussions with leaders of MIT entrepreneur-related activities, e.g. Technology Licensing Office, Deshpane Center, Venture Mentoring Service, as well as successful entrepreneurs and venture capitalists. Required entry course for E
& I option. Restricted to those in MIT Sloan MBA Entrepreneurship & Innovation option.

E. Roberts

15.362 Entrepreneurship Study Tour of Silicon Valley (New)
Prereq: 15.360
G (IAP)
1-0-0 [P/D/F] H-LEVEL Grad Credit

Intensive group tour of Silicon Valley, focusing upon understanding an entrepreneurial ecosystem. Visits to prominent venture capitalists and large numbers of primarily early-stage high-technology new ventures. Required entry subject for E & I option. Restricted to those in MIT Sloan MBA Entrepreneurship & Innovation option. E. Roberts, K. Morse

15.363J Strategic Decision Making in the Biomedical Business
(Same subject as HST.971J)
Prereq: —
G (Fall, Spring)
3-0-6

Key strategic decisions faced by managers, investors and scientists at each stage in the value chain of the life science industry. Aims to develop students’ ability to understand and effectively assess these strategic challenges. Focus on the biotech sector, with additional examples from the pharmaceutical and medical device sectors. Case studies, analytical models and detailed quantitative analysis. Intended for students interested in building a life science company or working in the sector as a manager, consultant, analyst or investor. Provides analytical background to the industry for biological and biomedical scientists, engineers and physicians with an interest in understanding the commercial dynamics of the life sciences or the commercial potential of their research. F. Murray

15.365J Disruptive Technologies: Predator or Prey?
(Same subject as ESD.58J)
Prereq: —
G (Spring)
3-0-6

Focuses on the management of product and process innovation and on economic, management, and technological influences on innovation. Both sustaining and disruptive innovations in products and manufacturing processes covered in lectures and cases presented by the leaders of change in different industries. Emphasis on emerging and disruptive technologies as seen from the points of view of entering firms (predators) and incumbent firms (prey) are covered in a class exercise, and project (preferably done in small groups). J. M. Utterback

15.369 Corporate Entrepreneurship: Strategies for Technology-Based New Business Development
Prereq: 15.351, 15.350
G (Fall)
2-0-4 H-LEVEL Grad Credit

Strategic and organizational issues in the development of new technologies and new business areas for existing firms. Issues examined from the perspectives of both large corporations and emerging technology-based enterprises. Linkages between internal and external sources of technology in major new business development. Examination of internal entrepreneurial ventures, alliances (especially between large and new companies), joint ventures, acquisitions, corporate venture capital investments, and licensing as alternative business development approaches. Covers aspects of corporate business development other than mergers and acquisition (M&A) activities. Outside speakers supplement faculty lectures. Student teams prepare term reports on a competitive analysis of some aspect of corporate business development. Half-term subject. E. Roberts

15.371J Innovation Teams
(Same subject as 10.807J)
Prereq: Permission of instructor
G (Fall, Spring)
3-2-4

See description under subject 10.807J.

C. Cooney, E. Roberts, K. Zolot

15.380 Special Studies in Entrepreneurship
Prereq: Graduate student standing
G (Fall, IAP, Spring, Summer)
Units arranged

Advanced work or special investigation of an entrepreneurial topic not specifically covered elsewhere and not qualifying as a thesis. Readings, conferences, laboratory and fieldwork, and reports.

Consult Entrepreneurship Center Faculty

15.387 Technology Sales and Sales Management
Prereq: —
G (Fall, Spring)
3-0-3

Practical and tactical ins and outs of how to sell technical products to a sophisticated marketplace. How to build and manage a sales force; building compensation systems for a sales force, assigning territories, resolving disputes, and dealing with channel conflicts. Focus on selling to customers, whether through a direct salesforce, a channel salesforce, or building an OEM relationship. Half term course. K. Morse, P. Bell, H. Anderson

15.388 Designing and Leading the Innovative Organization
Prereq: —
G (Spring)
2-0-4

Covers the building, running and growing of an organization. Subject has four central themes: how to think analytically about designing organizational systems; how leaders, especially founders, play a critical role in shaping an organization’s culture; what really needs to be done to build a successful organization for the long-term; and what can one do to improve the likelihood of personal success. Principles of organizational architecture, group behavior and performance, interpersonal influence, leadership and motivation. Through a series of cases, lectures, readings and exercises, students develop competencies in organizational design, human resources management, leadership and organizational behavior. Restricted to MIT Sloan Fellows in Innovation and Global Leadership. D. Burton

15.389 Global Entrepreneurship Lab: Emerging Markets
Prereq: —
G (Fall, IAP, Spring)
6-0-6

Enables teams of students to work with the top management of global start-ups and gain experience in starting and running a new enterprise outside the US. Focuses on start-ups operating in various emerging markets. Lectures expose students to the issues and policies that affect the climate for innovation and start-up success around the world. Begins in Fall term and continues for three weeks during IAP, when students spend time at project sites. Concludes with poster session in GLAB day at beginning of the Spring term. Students must complete all three components to receive credit. Restricted to graduate students. S. Johnson, S. Loessberg

15.390 New Enterprises
Prereq: —
G (Fall, Spring)
2-1-6

Covers the process of identifying and quantifying market opportunities, then conceptualizing,
management, and starting a new, technology-based enterprise. Topics include opportunity assessment, the value proposition, the entrepreneur, legal issues, entrepreneurial ethics, the business plan, the founding team, seeking customers and raising funds. Students develop detailed business plans for a start-up. Intended for students who want to start their own business, further develop an existing business, be a member of a management team in a new enterprise, or better understand the entrepreneur and the entrepreneurial process.

N. Afeyan, H. Anderson, K. Zolot

15.391 Early Stage Capital
Prereq: Permission of instructor
G (Fall)
3-0-3 H-LEVEL Grad Credit

Focuses on the strategy as well as the tactics involved in negotiating and building effective, long-term relationships with investors, including venture capitalists and angels. Other topics include an introduction to understanding venture capital as a business; the legal framework of the investment process and its related jargon; market practice and standards for term sheet negotiation; and strategies in identifying the optimal form of early stage capital. Coursework is team-centered: in two rounds of simulations, student teams assume the roles of founders of a start-up and first meet with practicing lawyers to gain advice and practical experience working with professional advisers. Teams then negotiate final terms of investment for their company with leading local VCs. Simulations are outside of class, off-campus at lawyers’ and VCs’ offices.

S. Loesberg

15.393 Technology and Entrepreneurial Strategy
Prereq: 15.901 or 15.011
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit

Explains building a technology strategy in start-up organizations focused on emerging technology. Outlines tools for formulating and evaluating technology strategy in entrepreneurial start-ups when the technology is emerging and leading-edge. Subject includes a number of lectures on key technology themes (which vary each year) and how to assess the commercial opportunities presented by emerging technology. Managerial content includes an introduction to models of technological change, models of new firm strategy development, and models of organizational strategy in high-tech start-ups. Topics include matching new technologies and markets; making money from innovation; competition between technologies; strategies for competing against established incumbents; technology portfolio development; and theories of diffusion and adoption. Taught using a combination of readings and case studies. Covers much of the same conceptual material as 15.912 but with an emphasis on entrepreneurial start-ups and emerging technology. Case study material is mainly from start-ups and fast-growing firms.

F. Murray

15.394 Designing and Leading the Entrepreneurial Organization
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

This subject is about building, running, and growing an organization. Subject has four central themes: (1) How to think analytically about designing organizational systems, (2) How leaders, especially founders, play a critical role in shaping an organization’s culture, (3) What really needs to be done to build a successful organization for the long-term; and (4) What one can do to improve the likelihood of personal success. Not a survey of entrepreneurship or leadership; subject addresses the principles of organizational architecture, group behavior and performance, interpersonal influence, leadership and motivation in entrepreneurial settings. Through a series of cases, lectures, readings and exercises students develop competencies in organizational design, human resources management, leadership and organizational behavior in the context of a new, small firm.

D. Burton

15.395 Entrepreneurship Without Borders
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

Examines the opportunities and problems for entrepreneurs outside the US, particularly in emerging markets. Students gain understanding of the linkage between the business environment, the institutional framework, and new business creation. They also learn the analytics of venture finance. In addition to discussing the range of global entrepreneurial situations, student groups pick one particular market opportunity on which to focus and develop an outline business plan. Classroom interactions based primarily on case studies.

S. Johnson, R. M. Locke

15.396 Special Seminar in Entrepreneurship
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged

Group study of current topics related to entrepreneurship not otherwise included in the curriculum.

K. Morse

15.397 Special Seminar in Entrepreneurship
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Individual or group study of current topics related to high tech entrepreneurship not otherwise included in the curriculum.

K. Morse

15.398 Corporations at the Crossroads: The CEO Perspective
Prereq: —
G (Spring)
2-0-4

Focus is on the role of the CEO. Students learn from some of the world’s leading CEO’s who are invited to speak in the class. Topics include the job of the CEO, corporate strategy, and career learnings and advice. The sessions are highly interactive, with questions from the students. In addition, before each class, a small group of students has dinner with the guest CEO, a truly unique experience for the students.

H. Anderson, P. Kurzina

15.399 Entrepreneurship Lab
Prereq: —
G (Fall, Spring)
2-9-1

Teams of science, engineering, and management students participate actively one day a week on-site with the top management of high tech start-ups in order to gain experience in starting and running a new venture. Student projects focus on one urgent aspect of the start-up, such as selection of target market, design of market-entry strategy, choice of sales approach to initial customers, etc. In addition to the regular MIT registration process, students should register at the course website one month before class to facilitate formation of student teams and matching of teams with potential host companies. Restricted to graduate students.

Consult B. Bund, K. Morse, J. Preston

See also 15.136f.
FINANCE

15.401 Finance Theory I
Prereq: —
G (Fall, Spring)
4-0-5
Topics: functions of capital markets and financial intermediaries; fixed income investments; diversification and portfolio selection; valuation theory and equilibrium pricing of risky assets; the theory of efficient markets; and an introduction to derivatives.
L. Kogan, A. Pavlova, J. Wang

15.402 Finance Theory II
Prereq: 15.401 or 15.407
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit
Continuation of 15.401, concentrating on corporate financial management. Topics include capital budgeting, investment decisions and valuation; working capital management, security issues; dividend policy; optimal capital structure; and real options analysis.
P. Asquith, N. Bergman, D. Jenter

15.407 Finance Theory
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-6 H-LEVEL Grad Credit
Core theory of capital markets and corporate finance. Topics: functions and operations of capital markets, analysis of consumption-investment decisions of investors, diversification and portfolio selection, valuation theory and equilibrium pricing of risky assets, theory of efficient markets, and investment and financing decisions of firms. Theoretical foundation for further study and practical applications.
For Financial Technology Option students or by permission of instructor.
A. W. Lo, J. Wang

15.408 Quantitative Investment Management
Prereq: 15.407 and related FTO curriculum requirements
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
Covers the most important innovations in investment technology within an integrative framework in which individual financial plan-
ning, corporate financial strategy, risk management, investment management, and proprietary trading can be analyzed quantitatively and implemented efficiently. Each topic is motivated by specific industry-driven issues in the investment process, lectures, problem sets, and group projects develop in detail the key analytical tools that comprise modern investment technology, including static and dynamic portfolio optimization; Monte Carlo simulation; and financial econometrics. Each of these techniques is covered in some depth, but the emphasis is on financial applications, not on methodology. For Financial Technology Option students or by permission of instructor.
A. Schoar

15.414 Financial Management
Prereq: 15.511
G (Summer)
3-0-6 H-LEVEL Grad Credit
Introduction to corporate finance and capital markets. Topics include project and company valuation, real options, measuring risk and return, stock pricing and the performance of trading strategies, corporate financing policy, the cost of capital, and risk management. Subject provides a broad overview of both theory and practice. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.
Staff

15.416J Introduction to Financial Economics
(Same subject as 14.416J)
Prereq: 14.121, 14.122
G (Fall)
4-0-8 H-LEVEL Grad Credit
Foundations of modern financial economics; individuals’ consumption and portfolio decisions under uncertainty; valuation of financial securities. Topics include expected utility theory; stochastic dominance; mutual fund separation; portfolio frontiers; capital asset pricing model; arbitrage pricing theory; Arrow-Debreu economies; consumption and portfolio decisions; spanning; options; market imperfections; no-trade theorems; rational expectations; financial signaling. Primarily for doctoral students in accounting, economics, and finance.
S. A. Ross

15.427J Real Estate Capital Markets
(Same subject as 11.432J)
Prereq: 11.431J; 15.401, 15.402, or 15.407
G (Spring)
2-0-4 H-LEVEL Grad Credit
See description under subject 11.432J.
D. Geltner

15.428J Advanced Topics in Real Estate Finance
(Same subject as 11.434J)
Prereq: —
G (Spring)
2-0-4
See description under subject 11.434J.
D. Geltner

15.431 Entrepreneurial Finance
Prereq: 15.402
G (Spring)
3-0-6 H-LEVEL Grad Credit
Examines the elements of entrepreneurial finance, focusing on technology-based start-up ventures, and the early stages of company development. Addresses key questions which challenge all entrepreneurs: how much money can and should be raised; when should it be raised and from whom; what is a reasonable valuation of the company; and how funding, employment contracts and exit decisions should be structured. Aims to prepare students for these decisions, both as entrepreneurs and venture capitalists. In-depth analysis of the structure of the private equity industry.
A. Schoar

15.433 Investments
Prereq: 15.401 or 15.407
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit
Financial theory and empirical evidence for making investment decisions. Topics include: portfolio theory; equilibrium models of security prices (including the capital asset pricing model and the arbitrage pricing theory); the empirical behavior of security prices; market efficiency; performance evaluation; and behavioral finance. Enrollment priority is given to Course 15 students.
J. Pan

15.434J Advanced Corporate Finance
Prereq: 15.402, 15.411, or 15.414
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit
Advanced topics in corporate finance including complex valuations, static and dynamic capital structure, risk management, and real options.
15.437 Options and Futures Markets
Prereq: 15.401 or 15.407
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit
Examines the economic role of options and futures markets. Topics: determinants of forward and futures prices, hedging and synthetic asset creation with futures, uses of options in investment strategies, relation between puts and calls, option valuation using binomial trees and Monte Carlo simulation, implied binomial trees, advanced hedging techniques, exotic options, applications to corporate securities and other financial instruments.
Consult J. C. Cox

15.440 Advanced Financial Economics I
(Same subject as 14.440)
Prereq: 15.416
G (Spring)
3-0-9 H-LEVEL Grad Credit
Covers advanced topics in the theory of financial markets with a focus on continuous time models. Topics include multiperiod securities markets and martingales; pricing of contingent securities such as options; optimal consumption and portfolio problems of an individual; dynamic equilibrium theory and the intertemporal capital asset pricing model; term structure of interest rates; and equilibrium with asymmetric information, transaction costs, and borrowing constraints. Primarily for doctoral students in accounting, economics, and finance.
L. Kogan

15.441 Advanced Financial Economics II
(Same subject as 14.441)
Prereq: 14.121, 14.122, or 15.416
G (Spring)
3-0-9 H-LEVEL Grad Credit
Surveys selected topics in current advanced research in corporate finance. Theoretical and empirical analyses of corporate financing and investment decisions. Some background in information economics and game theory is useful. Primarily for doctoral students in accounting, economics, and finance.
Faculty

15.442 Advanced Financial Economics III
(Same subject as 14.442)
Prereq: 14.382, 15.416, or permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Recent empirical methods in finance, including: the estimation and testing of market efficiency; the random walk hypothesis; the CAPM/APT; various term structure models; option pricing theories; and market microstructures; performance evaluation; bond rating and default analysis; event study methodology; continuous-time econometrics; and general time series methods. An empirical term project is required. Some econometric background and rudimentary computer programming skills are assumed. Primarily for doctoral students in finance, accounting, and economics.
Consult A. Lo

15.448–15.449 Special Seminar in Finance
Prereq: 15.402
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Group study of current topics related to finance not otherwise included in curriculum.
J. C. Cox

15.451 Proseminar in Financial Engineering
Prereq: 15.401 or 15.407; 15.437
G (Fall)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Provides students a unique opportunity to tackle original research problems in financial engineering that have been posed by leading experts from the financial community. Students are assigned to teams and each team is assigned one such problem. The team’s solution is then presented at a seminar which is open to the entire MIT community.
M. Kritzman

15.452 Proseminar in Financial Management
Prereq: 15.402
G (Fall)
2-0-4 H-LEVEL Grad Credit
Can be repeated for credit
Bridges the gap between finance theory and finance practice, and introduces students to the broader financial community. Students participate in a series of proseminars with industry guest speakers. Each guest, in collaboration with finance faculty, provides a problem and materials to a team of students. Each team then prepares a report and presents their analysis to the guest speaker and other students for evaluation and feedback.
C. Holderness

ACCOUNTING

15.501 Corporate Financial Accounting
(Subject meets with 15.516)
Prereq: —
U (Fall, Spring)
3-0-9
Preparation and analysis of financial statements. Focuses on measuring and reporting of corporate performance for investment decisions, stock valuation, bankers' loan risk assessment, and evaluations of employee performance, for example. Emphasizes the necessarily interdisciplinary understanding of business. Concepts from finance and economics (e.g., cash flow discounting, risk, valuation, and criteria for choosing among alternative investments) place accounting in the context of the business enterprise.
J. Altamura, R. LaFond

15.511 Financial Accounting
Prereq: —
G (Summer)
3-0-6
Corporate financial information is widely used in making investment decisions, corporate and managerial performance assessment, and valuation of firms. Basic concepts of corporate financial accounting and reporting. Perform economics-based analysis of accounting information from the viewpoint of the users of accounting information (especially senior managers) rather than the preparer (the accountant). Restricted to MIT Sloan Fellows in Innovation and Global Leadership.
S. P. Kothari

15.514 Financial and Managerial Accounting
Prereq: —
G (Summer)
3-0-9
An intensive introduction to the preparation and interpretation of financial information for investors (external users) and managers (internal users) and to the use of financial instruments to support system and project creation. Adopts a decision maker perspective on accounting and finance. Restricted to System Design and Management students.
S. P. Kothari
15.515 Financial Accounting
Prereq: Permission of instructor
G (Fall)
4-0-5 H-LEVEL Grad Credit

An intensive introduction to the preparation and interpretation of financial information. Adopts a decision-maker perspective of accounting by emphasizing the relation between accounting data and the underlying economic events generating them. Class sessions are a mixture of lecture and case discussion. Assignments include textbook problems, analysis of financial statements, and cases. Restricted to first-year Sloan master's students.

J. Weber

15.516 Corporate Financial Accounting
(Subject meets with 15.501)
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit (H except for Course 15 students)

See description under subject 15.501. If subject is oversubscribed, priority is given to Course 15 students.

Consult S. P. Kothari

15.518 Taxes and Business Strategy
Prereq: 15.501, 15.511, 15.515, or 15.516
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit

Provides a conceptual framework for thinking about taxes. Applications covered include mergers and acquisitions, tax arbitrage strategies, business entity choice, executive compensation, multi-national tax planning, and others. Aimed at investment bankers and consultants who need to understand how taxes affect the structure of deals; managers and analysts who need to understand how firms strategically respond to taxes; and entrepreneurs who want to structure their finances in a tax-advantaged manner.

S. P. Kothari

15.521 Management Accounting and Control
Prereq: 15.501, 15.511, 15.515, or 15.516
G (Spring)
3-0-6 H-LEVEL Grad Credit

Examines management accounting and related analytical methodologies for decision making and control in organizations. Product costing, budgetary control systems, and performance evaluation systems for planning, coordinating, and monitoring the performance of a business. Defines principles of measurement and develops framework for assessing behavioral dimensions of control systems; impact of different manage-rial styles on motivation and performance in an organization.

M. Khan

15.522 Security Design and Corporate Financing
Prereq: 15.515; 15.433 or 15.434
G (Spring)
3-0-6 H-LEVEL Grad Credit

Examines how corporations choose securities and markets to finance themselves. These are decisions which the firm must make after it has determined its financial policies including capital structure and dividend policy. Subject discusses recent trends in corporate financing including globalization, securitization, and transformation. Explores new securities and institutional factors, particularly tax and accounting factors that affect their design.

P. Asquith

15.535 Business Analysis Using Financial Statements
Prereq: 15.501, 15.511, 15.515, or 15.516; 15.411, 15.414, 15.401, or 15.407
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit

Presents a framework for business analysis and provides students with tools for financial statement analysis, including strategic, accounting, financial, and prospective analysis. Concepts are then applied to a number of decision making contexts, such as credit analysis, investor communications, merger analysis, financial policy decisions, and securities analysis.

Fall: J. Altamuro
Spring: P. Wysocki

15.539 Doctoral Seminar in Accounting
Prereq: 15.515
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Designed primarily for doctoral students in accounting and related fields. The reading list consists of accounting research papers. Objective is to introduce research topics, methodologies, and developments in accounting, and train students to do independent research.

S. P. Kothari

15.545 Mergers and Acquisitions: The Market for Corporate Control
Prereq: 15.401, 15.407, 15.411, or 15.414; 15.402; 15.511, 15.515, or 15.516
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit

Probably the most dramatic events in a corporation’s history involve the decision to acquire another firm or the decision to oppose being acquired. This is also one of the areas of management most thoroughly documented in the financial press and the academic literature. Subject explores three aspects of the merger and acquisition process: the strategic decision to acquire, the valuation decision of how much to pay, and the financing decision of how to fund the acquisition. Class sessions alternate between discussions of academic readings and applied cases.

Staff

INFORMATION TECHNOLOGIES

15.561 Information Technology Essentials
Prereq: —
G (Spring)
3-0-6

Examines technology concepts and trends underlying current and future uses of information technology (IT) in business. Emphasis on networks and distributed computing, including the web. Other topics include hardware and operating systems, software development tools and processes, relational databases, security and cryptography, enterprise applications, and electronic commerce. Exposure to web, database, and graphical user interface (GUI) tools. Primarily for Sloan master’s students with limited IT background.

T. W. Malone

15.564 IT Essentials II: Advanced Technologies for Digital Business in the Knowledge Economy
Prereq: —
G (Spring)
3-0-6

Technologies and concepts for next generation knowledge management and web e-business, including semantic web and web services. Business applications for use in the next two to seven years, including: e-commerce, marketing, finance, trust/security, health/biomedical, mobile. Strategic impacts and entrepreneurial opportunities. Core skills for identifying and evaluating technologies and their business potential, and for managing innovative IT-dependent projects. Overall emphasis on business process automation and e-services.

B. Grosof
15.565| Integrating Information Systems: Technical, Strategic, and Organizational Factors
(Same subject as ESD.565)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
Credit cannot also be received for 15.578

Emphasis on modern communications and internet technologies and database and web technologies, and their role in supporting the integration of information systems. Presents frameworks for understanding integrating concepts and the strategic and organizational factors impacting success of IT in business. Issues addressed include technical factors—local-area, wide-area, and internet communications networks, distributed databases, data extraction from websites, semantic web, semantic reconciliation among heterogeneous sources; strategic factors—globalization and integration of information, competitive forces, interlinked value chains; organizational factors—loosely coupled organizations, development of standards, motivating strategic alliances.
S. Madnick

15.567 The Economics of Information: Strategy, Structure and Pricing
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Analysis of the underlying economics of information with management implications. Topics include industry structure, incentives, and business organization. Pricing, bundling and versioning of digital goods including music, video, software and communication services. Managerial uses of intellectual property, innovation incentives, search, targeted advertising, personalization, privacy, network externalities, open source and alliances. Discussion of principles, cases, industry speakers and a team project.
E. Brynjolfsson

15.568 Management of Information Systems
Prereq: 1.00 or 6.001
U (Spring)
3-0-6

Covers how the business value of individuals, as well as of organizational investments and innovation, is maximized in IT. Topics include IT-specific project-management, outsourcing, business-process design, alignment with organizational goals, operational efficiencies, change management, business transformation, agility, and associated strategy. Complements knowledge of programming or technology with organizational and people aspects. Emphasizes effective pragmatic decision-making. Presents and uses analytical frameworks, concepts, guidelines, cases, field research, and extensive discussion. Restricted to undergraduates.
B. Grosof

15.569 Organizations as Enacted Systems: Learning, Knowing, and Change
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

Structured around a core of fundamental concepts concerning how people view organizations, and the application of these concepts to basic domains of action crucial for contemporary businesses: sensemaking, learning, knowing, and change. Views organizations as enacted systems, wherein humans are continually shaping the structures that influence their action in turn. Reflective practice weaves theory, group exercises, and case studies.
W. Orlikowski, P. Senge

15.571 Generating Business Value from IT
Prereq: —
G (Spring)
3-0-6

Provides concepts, frameworks, practice and evidence to help managers generate business value from information technology in their enterprises. Takes the strategic perspective of the general manager and studies how leading firms get more value from their IT investments. Focuses on the business value that can be achieved rather than the details of the technology. Topics include business operating models; IT portfolios; IT investment and justification; business strategy and IT alignment; IT infrastructure; IT architecture and IT governance. Draws heavily on research and case studies from MIT Sloan Center for Information Systems Research. Restricted to graduate students.
P. Weill

15.575 Research Seminar in Information Technology and Organizations: Economic Perspectives
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines the assumptions, concepts, theories, and methodologies that inform research into the social aspects of information technology. Explores critical issues of communications and connectivity of global and internet-based information systems from strategic, technical, and organizational perspectives. Strategic connectivity: globalization and integration of information, competitive forces, interlinked value chains. Physical connectivity: protocols and technologies of local-area and wide-area, and internet communications networks. Logical connectivity: distributed databases, data extraction from websites, semantic web, semantic reconciliation among heterogeneous sources. Organizational connectivity: loosely coupled organizations, development of standards, motivating strategic alliances.
S. E. Madnick

15.576–15.580 Special Seminar in Information Technology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Group study of current topics related to information technology not otherwise included in curriculum.
S. E. Madnick, T. W. Malone, W. Orlikowski
15.599 Workshop in Information Technology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged
Can be repeated for credit
Presentations by faculty, doctoral students, and guest speakers of ongoing research relating to current issues in IT, as well as discussions of key research papers in the field. Specific topics determined by the interest of participants and by new and important directions in IT. Background readings and active participation by students expected. Primarily for doctoral students.
E. Brynjolfsson, W. Orlikowski

15.615 Basic Business Law for the Entrepreneur and Manager
Prereq: —
G (Fall, Spring)
3-0-6
One of three alternative courses (15.615, 15.616, and 15.617) each designed to provide managers with the solid foundation in business law needed to exercise judgment and leadership when confronting a broad range of complex law-sensitive issues. Includes most topics covered in 15.615, some at a quicker pace. Extra attention to mergers and acquisitions, capital markets and private equity, the regulation of financial service providers, and legal risks associated with innovative financial products and services. May appeal to students interested in finance.
J. Akula

15.616 Basic Business Law, Tilted Towards Innovation and Strategy
Prereq: —
G (Fall)
3-0-6
One of three alternative courses (15.615, 15.616, and 15.617) each designed to provide managers with the solid foundation in business law needed to exercise judgment and leadership when confronting a broad range of complex law-sensitive issues. Includes most topics covered in 15.615, some at a quicker pace. Extra attention to the legal frameworks of transnational business, cutting-edge technologies and products, and restructuring and repositioning major corporations. May appeal to students interested in strategic management and consulting.
J. Akula

15.617 Basic Business Law, Tilted Towards Finance
Prereq: —
G (Spring)
3-0-6
One of three alternative courses (15.615, 15.616, and 15.617) each designed to provide managers with the solid foundation in business law needed to exercise judgment and leadership when confronting a broad range of complex law-sensitive issues. Includes most topics covered in 15.615, some at a quicker pace. Extra attention to mergers and acquisitions, capital markets and private equity, the regulation of financial service providers, and legal risks associated with innovative financial products and services. May appeal to students interested in finance.
J. Akula

15.628 Patents, Copyrights, and the Law of Intellectual Property
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
2-0-4 [P/D/F] H-LEVEL Grad Credit
Introductory examination of the US law of intellectual property, with emphasis on patents and copyrights, and a brief look at trademarks, trade secrets, and license agreements. Comparisons made with regard to what can and cannot be protected, what rights the owner does and does not obtain, and how these rights come into being. Issues relating particularly to new information technologies highlighted. Assignments include case and statutory readings, written preparatory exercises, and student case presentations. Regular attendance required. No listeners.
J. A. Meldman

15.647–15.649 Special Seminar in Law
Prereq: —
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Group study of current topics related to law not otherwise included in curriculum.
J. L. Akula

15.655] Law, Technology, and Public Policy
(Same subject as ESD.132)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.132).
N. A. Ashford, C. C. Coldart

15.657] Sustainability, Trade, and the Environment
(Same subject as 1.813J, 11.466J, ESD.137J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.137J.
N. A. Ashford

15.658] Legal Issues in the Development Process
(Same subject as 11.340J)
Prereq: Permission of instructor
G (Spring)
3-0-3 H-LEVEL Grad Credit
See description under subject 11.340J.
L. Fisher

INDUSTRIAL RELATIONS AND HUMAN RESOURCE MANAGEMENT

15.660 Strategic Human Resource Management
Prereq: 15.311
G (Spring)
2-0-4 H-LEVEL Grad Credit
Design and execution of human resource management strategies. Two central themes: How to think systematically and strategically about aspects of managing the organization’s human assets, and what really needs to be done to implement these policies and to achieve competitive advantage. Adopts the perspective of a general manager and addresses human resource topics (including reward systems, performance management, high-performance human resource systems, training and development, recruitment, retention, equal employment opportunity laws, work-force diversity, and union-management relationships) from a strategic perspective.
D. Burton, E. Castilla

15.664 Careers, Leadership, and Negotiations in the New Economy
Prereq: —
U (Fall)
4-0-8
Discusses how work, careers, and organizations are changing and the leadership skills required of professionals in contemporary organizations and society. Topics include the changing nature of work and careers, the role of knowledge in organizations and the economy, work-family integration, negotiations and conflict management, teamwork, leadership, and the management of diversity. Classes involve simulations, cases and negotiation exercises. Students develop a
personal leadership and career development plan and work in teams to conduct an action-research project on campus related to one of the subject’s topics.

P. Osterman, T. Kochan

15.665 Power and Negotiation
Prereq: Permission of instructor
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit

Provides understanding of the theory and processes of negotiation as practiced in a variety of settings. Designed for relevance to the broad spectrum of bargaining problems faced by the manager and professional. Allows students an opportunity to develop negotiation skills experimentally and to understand negotiation in useful analytical frameworks. Emphasizes simulations, exercises, role playing, and cases. Undergraduates may register for this subject provided they are ready to participate with the intensity expected for a grad H-level subject.

J. Curhan, L. Bacarro

15.667 Negotiation and Conflict Management
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Presents negotiation theory—strategies and styles—within an employment context. Special emphasis on sources of power in negotiation. Covers conflict management as a first party and as a third party. Third-party skills include helping others deal directly with their conflicts, mediation, investigation, arbitration, and helping the system itself to change as a result of a dispute. Special cases include abrasiveness, dangerousness, racism, sexism, whistleblowing, and ethics. Simulations of difficult situations such as cross-cultural mentoring and an emergency. One double class. Requires a commitment to attend all classes. Undergraduates may register for this subject provided they are ready to participate with the intensity expected for a grad H-level subject.

M. P. Rowe, T. Kochan

15.668 People and Organizations
Prereq: —
U (Fall)
3-0-6

Examines the historical evolution and current human and organizational contexts in which scientists, engineers and other professionals work. Outlines today’s major challenges facing the management profession. Uses interactive exercises, simulations and problems to develop critical skills in negotiations, teamwork and leadership. Introduces concepts and tools to analyze work and leadership experiences in optional undergraduate fieldwork projects. Priority given to students in the Minor in Management and to other undergraduates not majoring in Management Science.

T. Kochan, R. Fernandez, J. Carroll, E. Westney

15.670 Leadership and Change
Prereq: 15.668, approved fieldwork experience
U (Fall)
2-0-4

Applies concepts introduced in 15.668. Explores leadership and organizational change learned as a result of fieldwork experience. Alternative styles of leadership analyzed. Development of personal leadership plans. First half term course.

Staff

15.676 Work, Employment, and Industrial Relations Theory
Prereq: Permission of instructor
G (Spring)
2-0-7 H-LEVEL Grad Credit
Can be repeated for credit

Historical evolution and assessment of different theories and disciplinary perspectives used in research on work, employment, and industrial relations. Introduces doctoral students to the field and explores where their research interests fit within the broader field. First part compares the normative assumptions, theories, and methodologies used by economists, historians, sociologists, psychologists, political scientists, and legal scholars from the latter nineteenth century to the present. Final portion explores strategies for advancing research on topics of current interest to participants.

T. Kochan, D. Burton, R. M. Locke, P. Osterman

15.677J Urban Labor Markets and Employment Policy
(Same subject as 11.427J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Discusses the broader trends in the labor market, how urban labor markets function, public and private training policy, other labor market programs, the link between labor market policy and economic development, and the organization of work within firms.

P. Osterman

15.678J Political Economy I: Theories of the State and the Economy
(Same subject as 14.781J, 17.100J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 17.100J.

M. Piore, S. Berger

15.691 Research Seminar in Work, Employment and Industrial Relations
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Discusses important areas for research in work, employment and industrial relations; frameworks for research, research techniques, and methodological problems. Centered mainly on staff research and the thesis research of advanced graduate students and invited guests.

Consult T. A. Kochan

15.698 Special Seminar in Industrial Relations and Human Resource Management
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Group study of current topics related to industrial relations and human resource management not otherwise included in curriculum.

Consult P. Osterman

OPERATIONS MANAGEMENT

15.760 Introduction to Operations Management
Prereq: 15.060 or 6.041
G (Spring)
3-0-6 H-LEVEL Grad Credit

Introduction to problems and analysis related to the design, planning, control and improvement of manufacturing and service operations. Includes process analysis, project analysis, materials management, production planning and scheduling, quality management, supply chain design and coordination, reengineering, design for manufacturing, capacity and facilities planning, and operations strategy. 15.761 primarily for LFM students and focuses on manufacturing operations.

D. Rosenfield
15.762| Supply Chain Planning
(Same subject as 1.273J, ESD.267J)
Prereq: 1.260J, 15.760, or 15.761
G (Spring)
2-0-4 H-LEVEL Grad Credit

Focuses on effective supply chain strategies for companies that operate globally, with emphasis on how to plan and integrate supply chain components into a coordinated system. Students are exposed to concepts and models important in supply chain planning with emphasis on key trade-offs and phenomena. Introduces and utilizes key tactics such as risk pooling and inventory placement, integrated planning and collaboration, and information sharing. Lectures, computer exercises, and case discussions introduce various models and methods for supply chain analysis and optimization. Recommended for Operations Management concentrators. First half-term subject.

S. C. Graves, D. Simchi-Levi

15.763| Manufacturing System and Supply Chain Design
(Same subject as 1.274J, ESD.268J)
Prereq: 1.260, 15.760, or 15.761
G (Spring)
2-0-4 H-LEVEL Grad Credit

Focuses on decision making for system design, as it arises in manufacturing systems and supply chains. Students exposed to frameworks and models for structuring the key issues and trade-offs. Presents and discusses new opportunities, issues and concepts introduced by the internet and e-commerce. Introduces various models, methods and software tools for logistics network design, capacity planning and flexibility, make-buy, and integration with product development. Industry applications and cases illustrate concepts and challenges. Recommended for Operations Management concentrators. Second half-term subject.

S. C. Graves, D. Simchi-Levi

15.764| The Theory of Operations Management
Prereq: 15.081J or 6.251J, 6.431
G (Spring)
3-0-6 H-LEVEL Grad Credit

Can be repeated for credit

Focus on theoretical work for studying operations planning and control problems. Topics vary from year to year, and include supply chain design and coordination, logistic and distribution systems, make-to-order systems, call centers and service operations, procurement, pricing, revenue management, the sales/production interface, inventory theory, flexible manufacturing systems.

J. Golliet

15.765| International Supply Chain Management
(Same subject as 1.265J, 2.965J, ESD.265J)
Prereq: 1.260J, 1.261J, 1.262J, 15.760, or permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 2.965J.

H. S. Marcus, A. Weiss

15.768| Management of Services: Concepts, Design, and Delivery
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Credit cannot also be received for 15.778

Explores the difference between service and manufacturing operations, and the degree of distinct management skills and tools required. Based on lectures, cases selected from a variety of service operations with a particular interest on service business models (both online and offline) and their evolution or reinvention, readings, and on a service business simulation. Focuses on job opportunities in the service sector. Guest speakers present their experiences on various aspects of the service industry.

Faculty

15.769| Operations Strategy
Prereq: 15.760, 15.761, or permission of instructor
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit

Provides unifying framework for analyzing strategic issues in manufacturing and service operations. Analyzes relationships between manufacturing and service companies and their suppliers, customers, and competitors. Also covers decisions in technology, facilities, vertical integration, human resources and other strategic areas. Explores means of competition such as cost, quality, and innovativeness. Provides an approach to make operations decisions in the era of outsourcing and globalization.

Fall: D. B. Rosenfield
Spring: C. H. Fine

15.770| Logistics Systems
(Same subject as 1.260J, ESD.260J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Introduction to supply chain management from both analytical and practical perspectives. Stressing a unified approach, the course allows the student to develop a framework for making intelligent decisions within the supply chain.

Key logistics functions are covered to include demand planning, procurement, inventory theory and control, transportation planning and execution, reverse logistics, and flexible contracting. Concepts explored include postponement, portfolio management, dual sourcing, and others. Emphasis is placed on being able to recognize and manage risk, analyze various trade-offs, and model logistics systems.

Y. Sheffi, C. Coplace

15.771| Case Studies in Logistics and Supply Chain Management
(Same subject as 1.261J, ESD.261J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

A combination of lectures and cases covering the strategic, management, and operating issues in contemporary logistics and integrated supply chain management. Includes: logistics strategy; supply chain restructuring and change management; and distribution, customer service, and inventory policy.

J. Byrnes

15.778| Management of Supply Networks for Products and Services
Prereq: —
G (Summer)
3-0-6

Credit cannot also be received for 15.768

Integrated approach to the analysis, design and management of supply networks for products and services. Based on the study and discussion of concepts, examples, and case studies from a wide range of industries, the emphasis is on developing the following two critical themes: (1) a basic structure or foundation for analyzing, designing and operating supply chains (SCs) that relies on both fundamental concepts such as the management of SC inventory, planning of SC operations and logistics; as well as a discussion therein of the value of (timely) information, and of the need for collaboration and coordination between the SC players, (2) conceptual frameworks that focus on the emergence of a wide range of enabling services in SCs which in turn are proving to be the critical success factors for the survival and growth of this class of systems; as part of these frameworks we will also discuss ideas and models for managing service operations. Guest speakers will present personal experiences on various aspects of the service industry and supply chains. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.

Consult G. Bitran
15.783J Product Design and Development (Same subject as 2.739J, ESD.32J)
Prereq: 2.009, 15.760, 15.761, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Covers modern tools and methods for product design and development. The cornerstone is a project in which teams of management, engineering, and industrial design students conceive, design, and prototype a physical product. Class sessions employ cases and hands-on exercises to reinforce the key ideas. Topics include: product planning, identifying customer needs, concept generation, product architecture, industrial design, concept design, and design for manufacturing.
W. P. Seering

15.792J Proseminar in Manufacturing (Same subject as 2.890J, 3.80J, 10.792J, 16.985J)
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Provides an integrative forum for operations and manufacturing students and is the focus for projects in leadership, service, and improvement. Covers a set of integrative manufacturing topics or issues such as leadership, implementation of lean operations or other improvements, and presents examples of both operations excellence and challenges. Includes presentations by guest speakers such as senior level managers of manufacturing companies. Subject is largely managed by students. Primarily for LFM Fellows and Masters students interested in focusing in operations and manufacturing.
D. B. Rosenfield

15.794 Research Project in Manufacturing
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
A special projects subject designed for Leaders for Manufacturing (LFM) students in conjunction with on-site projects at LFM partner companies. Student teams work on faculty-supervised thesis research projects that deal with a specific aspect of manufacturing. Students required to summarize their work in the context of understanding organization, leadership, teamwork, and task management in conjunction with 15.317.
D. B. Rosenfield

15.795 Seminar in Operations Management
Prereq: 15.760 or 15.761
G (Spring)
3-0-6 H-LEVEL Grad Credit
Can be repeated for credit
Topics vary from year to year. Typical examples from past years: manufacturing strategy, technology supply chains.
C. H. Fine

15.799 Workshop in Operations Management
Prereq: —
G (Fall, Spring)
Units arranged
Can be repeated for credit
Presentations by faculty, doctoral students, and guest speakers of ongoing research related to current issues in operations management, including reports of research projects (proposed or in progress) and informal discussions of recent literature dealing with subjects of special interest to participants. Primarily for doctoral students.
T. Roemer

MARKETING

15.809 Marketing Management
Prereq: —
G (Summer)
3-0-6
Marketing is a rigorous, disciplined science that applies a reasoned framework to the selection of target markets and the optimization of marketing decisions. The subject has two parts: a tactical portion and a strategic portion. The strategic portion focuses on identifying target markets. The tactical portion reviews how firms optimize profits in their chosen markets. Tactical topics include pricing, promotion, channel and product issues. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.
D. Simester

15.810 Marketing Management
Prereq: —
G (Fall, Spring)
3-0-6
Analyze marketing problems through the lens of an analytical framework. Subject has both tactical and strategic portions. Tactical portion reviews methods firms use to optimize profits in markets they choose to target. Topics include pricing, promotion, distribution and product issues as well as how to gather customer input and differentiate yourself from competitors. Strategic portion focuses on identifying market-competencies and using these competencies to identify target markets and set marketing strategy. Explores theory and practice using lectures, cases, discussions, and readings.
J. R. Hauser, M. Braun

15.812 Marketing Management
Prereq: 14.01
U (Fall, Spring)
3-0-6
Provides a rigorous and comprehensive introduction to contemporary marketing practice such as customer analysis, market segmentation, targeting and positioning, product design and branding, pricing, promotion, and distribution. Taught using lectures, case studies, and class demonstrations. Not open to Sloan graduate students.
J. Zhang

15.818 Pricing
Prereq: —
G (Spring)
3-0-6
Framework for understanding pricing strategies and tactics. Topics covered include price customization, pricing complementary products, anticipating competitive price responses, pricing in platform markets, pricing in business to business markets, and pricing of new products. Lectures and cases.
C. Tucker

15.819 Foundations of Consumer Centric Technologies
Prereq: 15.810 or permission of instructor
G (Spring)
3-0-3 H-LEVEL Grad Credit
Starting from what is known from developmental psychology, cognitive science, and behavioral economics, subject explores the applications of these ideas to new products and services. Seminar divided between background knowledge on the particular topic and guided exploration of related applications. Half-term subject.
S. Ariely, D. Ariely

15.821 Listening to the Customer
Prereq: —
G (Fall)
3-0-3
Introduction to soft consumer research methods, useful for getting quick customer input into decisions on product design and development, strategic positioning, advertising, and branding. Covers interview techniques, observational methods, voice of the customer, focus groups, and analyses suitable for qualitative data.
Introduces new information-gathering methods in development at MIT.

D. Prelec

15.822 Strategic Market Measurement
Prereq: —
G (Fall)
3-0-3

Project subject teaches students how to create, carry out, interpret, and analyze a market research questionnaire. Emphasis on discovering market structure and segmentation, but students can pursue other project applications. Includes a user-oriented treatment of multivariate analysis (factor analysis, multidimensional scaling, conjoint and cluster analysis).

D. Prelec

15.828 Design and Marketing New Products
Prereq: 15.809, 15.810 or 15.812
G (Spring)
4-0-2 H-LEVEL Grad Credit

Practical introduction to the process of designing and marketing new products. Covers the major phases of product development: opportunity identification (customer input, generating ideas, market definition), product design and positioning, pre-market testing and forecasting, launch marketing, and managing the life cycle. Presents proven techniques, but emphasizes state of the art methods like “listening in”, virtual customer, information acceleration, and trust-based marketing. Group project allows students to apply lessons to the design and marketing of a real product—the hydrogen fuel auto. Half-term subject.

G. L. Urban

15.833 Business to Business Marketing
Prereq: 15.809, 15.810 or 15.812
G (Fall)
3-0-6 H-LEVEL Grad Credit

Applies marketing concepts, analyses and tools to situations in which the customer is an organization such as a company, an institution, or a government agency. Business to business (B2B) marketing is critical since purchases by organizations account for more than half of the economic activity in the US. Emphasizes customer value delivery. Analytical framework used to assess components of customer value and then translate them into actionable marketing strategies and programs. The goal of customer value management is to deliver superior value to targeted business segments while maintaining an equitable return on the value delivered. Brand building, web and technology facilitation of the supply chain, and customer relationship management are integral to the process. Ethical issues are discussed as they arise. Various B2B contexts such as products and services, for-profits and non-profits, domestic and global markets are discussed. Teaching methods include a business simulation, case studies, applied exercises, and readings.

S. Chatterjee

15.834 Marketing Strategy
Prereq: —
G (Spring)
3-0-6

Introduces tools from strategy and economics to look systematically at marketing strategy. Topics include how to maximize value for the customer-firm-supplier triad and how to develop new sources of competitive advantage. Taught mostly with cases. Half-term subject.

B. Wernerfelt

15.835 Entrepreneurial Marketing
Prereq: 15.809, 15.810 or 15.812
G (Spring)
3-0-6 H-LEVEL Grad Credit

Teaches students to do rigorous, explicit, customer-based marketing analyses which is most appropriate for new ventures. Explicit analysis of customers and potential customers, using available data, together with explicit and sensible additional assumptions about customer needs and behavior. Also teaches ways to implement marketing strategies when resources are very limited, and common deficiencies in marketing by entrepreneurial organizations.

Staff

15.836 New Product and Venture Development Proseminar
Prereq: —
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-3 [P/D/F]

Provides an overview and feel for what is involved in new product development within a larger organization, as well as in start-up firms. The key question is: How does an idea or an invention become a successful innovation in the marketplace? Seminar features a series of speakers who focus on specific aspects of this process, from topics such as “the fuzzy front end” that seed teams face, championing an idea through an organization, keeping an entrepreneurial spirit alive, growing pains, designing the business plan, meeting communications challenges, and using creative marketing techniques.

D. Prelec

15.838 Research Seminar in Marketing
Prereq: 15.810
G (Fall, Spring)
3-0-6 H-LEVEL Grad Credit
Can be repeated for credit

Seminar on current marketing literature and current research interests of faculty and students. Topics such as marketing models, consumer behavior, competitive strategy, marketing experimentation, and game theory. Restricted to doctoral students.

Consult D. Prelec

15.839 Workshop in Marketing
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Presentations by faculty, doctoral students, and guest speakers of ongoing research relating to current issues in marketing. Topics: reports of research projects (proposed or in progress) and informal discussions of recent literature dealing with subjects of special interest to participants. Restricted to doctoral students.

Staff

15.840–15.843 Special Seminar in Marketing
Prereq: 15.809, 15.810, or 15.812
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Group study of current topics related to marketing not otherwise included in curriculum.

Staff

15.844 Applied Individual Psychology
Prereq: —
G (Fall, Spring)
3-0-9

Psychological research reveals much about how individuals work, ranging from the most basic functions of perception and memory, to high level cognition and all the way to motivation and decision making. Introduces these concepts with an eye toward application of these basic principles into consumer and managerial settings.

D. Ariely

15.846 Branding
Prereq: 15.809, 15.810 or 15.812
G (Fall, Spring)
3-0-3 H-LEVEL Grad Credit

Covers elemental decisions about message design given different managerial objectives. Investigates the role of advertising in one particularly important objective, brand-building.
Using a discussion of current marketing research, focuses on the importance of consumer perception in advertising/branding efficacy and integrated marketing communications as an emerging goal in advertising efforts. Topics include smoky signals, sticky brands, and the medium/content interaction. Explores theory and practice using lectures, discussions, and readings. Half-term subject.

**Staff**

15.847 Consumer Behavior
Prereq: 15.809, 15.810 or 15.812
G (Spring)
3-0-3 H-LEVEL Grad Credit

Presents research from cognitive and social psychology, decision theory, and behavioral economics to help us understand why consumers buy (or not) and the rules they use to evaluate products and choose between them. Topics include “framing”; heuristics and biases of judgment and choice; the challenge of characterizing labile preferences; attitudes and attitude change; psychological issues in pricing; and social marketing. Emphasizes how experimental results (what we conclude about consumers from studies) and real world outcomes (what consumers actually do) are surprisingly sensitive to subtle procedural or contextual details. Half-term subject.

D. Ariely

15.848 Marketing Models
Prereq: 15.810, 15.060
G (Spring)
3-0-3

Quantitative models and methods in marketing such as choice models, positioning analyses, market response, inter-firm competition. Coverage includes the marketing phenomena under consideration, underlying modeling assumptions and their realism, the main implications of the model, and the insights gained. Undergraduates should have completed 15.812 and 6.041. Half term subject.

Consult J. Little

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**System Dynamics**

15.871 Introduction to System Dynamics
(Subject meets with 15.874)
Prereq: Permission of instructor
G (Fall, Spring)
2-0-4 H-LEVEL Grad Credit

15.874 System Dynamics for Business Policy
(Subject meets with 15.871)
Prereq: Permission of instructor
G (Fall, Spring)
4-0-8 H-LEVEL Grad Credit

Introduction to system dynamics modeling applied to strategy, organizational change, and policy design. Uses simulation models, management “flight simulators,” and case studies to develop conceptual and modeling skills for the design and management of high-performance organizations in a dynamic world. Case studies of successful applications of system dynamics in growth strategy, management of technology, operations, supply chains, product development, and others. Principles for effective use of modeling in the real world. Prerequisite for further work in the field. 15.871 is the half term version of 15.874. Meets twice weekly plus a weekly recitation session.

J. D. Sterman, N. P. Repenning, K. M. Thompson, M. A. Sastry

15.875 Applications of System Dynamics
Prereq: 15.874
G (Spring)
3-0-6 H-LEVEL Grad Credit

Can be repeated for credit

Explores how organizations can use system dynamics to achieve important goals. Student teams work with client managers to tackle the clients’ most pressing issues. Students discuss experiences with their clients, and learn modeling and consulting skills they need to be effective. Focus on gaining practical insight from the system dynamics process. Projects are sponsored by diverse organizations from a range of industries and sizes from start-ups to the Fortune 500.

Consult J. Sterman

15.879 Research Seminar in System Dynamics
Prereq: 15.874 and permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Doctoral level seminar in system dynamics modeling, with a focus on social, economic and technical systems. Covers classic works in dynamic modeling from various disciplines and current research problems and papers. Participants critique the theories and models, often including replication, testing, and improvement of various models, and lead class discussion. Topics vary from year to year.

Consult J. D. Sterman, N. P. Repenning

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**Strategic Management**

15.900 Strategic Management
Prereq: —
G (Spring)
3-0-6

Explores a wide range of strategic problems, focusing particularly on the sources of competitive advantage and the interaction between industry structure and organizational capabilities. Introduces a wide variety of modern strategy frameworks and methodologies. Builds upon and integrates material from core topics such as economics, organizational processes, and marketing. Restricted to first-year MBAs.

E. Zuckerman

15.902 Strategic Management
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Focuses on some of the important current issues in strategic management. Concentrate on modern analytical approaches and enduring successful strategic practices. Designed with a technological and global outlook since this orientation in many ways highlights the significant emerging trends in strategic management. Provides students with a pragmatic approach that guides the formulation and implementation of corporate, business, and functional strategies. Half-term subject. Restricted to MIT Sloan Fellows in Innovation and Global Leadership.

A. Hax

15.903 Corporate Strategy and Extended Enterprises
Prereq: 15.900, 15.010, 15.311
G (Spring)
2-0-4 H-LEVEL Grad Credit

How managers build and manage complex organizations to achieve strategic goals. Develops theoretical frameworks that build on 15.010, 15.311, and 15.900. Applies these frameworks to corporate strategy (i.e., the design and management of the multi-business firm) and extended enterprises (i.e., the design and management of multi-firm structures such as supply chains, alliances, joint ventures, and networks). Half-term subject.

R. Gibbons
15.905 Technology Strategy for SDM
Prereq: —
G (Spring)
3-0-3
Provides a series of strategic frameworks for managing high-technology businesses. Emphasis on the development and application of conceptual models which clarify the interactions between competition, patterns of technological and market change, and the structure and development of internal firm capabilities. Half-term subject. SDM students only, except with instructor permission.
Staff

15.912 Technology Strategy
Prereq: 15.900 or 15.903; and 15.011 or 15.024 G (Spring)
3-0-6 H-LEVEL Grad Credit
Outlines tools for formulating and evaluating technology strategy, including an introduction to the economics of technical change, models of technological evolution, and models of organizational dynamics and innovation. Topics covered include: making money from innovation; competition between technologies and the selection of standards; optimal licensing policies; joint ventures; organization of R&D; and theories of diffusion and adoption. Taught using a combination of readings and case studies. R. M. Henderson

15.914 Competitive Dynamics and Strategy—Winning in Technology Markets (New)
Prereq: 15.871 or 15.874; 15.365, 15.350, 15.351, 15.900, 15.902, or 15.912 G (Spring)
2-0-7 H-LEVEL Grad Credit
Focuses on competitive strategy in technology-driven markets. Explores the signature dynamics common to almost all such markets: innovation, technology substitution, product lifecycles, commoditization, disruption, transformation of mature businesses, and technology ecosystems. Over the term students acquire a portfolio of models of the signature dynamics. They use the models in projects with participating companies to analyze technology markets, formulate competitive strategies, and illuminate the challenges of execution. Issues addressed are critical for both established incumbents and new market entrants. It is a “master class” in applied corporate strategy. Restricted to graduate students. H. B. Weil

15.941J Leadership in the Real Estate Industry
(Same subject as 11.430J)
Prereq: 11.431J, 15.401, or 15.414 G (Fall)
3-0-6 H-LEVEL Grad Credit
Provides and uses theories, concepts and tools to craft, articulate and refine a leadership point of view. Through reflection, self-assessment, discussion and feedback, learn about readiness to lead, leadership style, emotional intelligence, and presentation of self. Converse with leaders in the real estate industry and learn from their stories and insights. At the conclusion of the course, students have a deeper understanding of leadership; a better understanding of themselves and their authentic leadership style; and a plan for the ongoing development of their leadership capabilities.
G. Schuck

15.943 Explaining Heterogeneity in Firm Performance
Prereq: 14.121, 14.122, 14.271, 14.382, or permission of instructor G (Spring)
3-0-3 H-LEVEL Grad Credit
Focuses on the sources of heterogeneity in firm performance. Most research in economics, particularly in industrial organization theory, assumes that firms are homogeneous in terms of knowledge, production structure, and factor price environment. Research in the tradition of strategic management, in contrast, focuses attention on heterogeneity across firms as the primary driver of the nature of competition and of the sources of firm performance. Introduces doctoral students in strategic management and economics to the evidence for persistent heterogeneity. Restricted to doctoral students.
P. Azoulay

15.944 The Economic and Strategic Analysis of Technology Intensive Industries
Prereq: 14.121, 14.122, 14.271, 14.382, or permission of instructor G (Spring)
3-0-3 H-LEVEL Grad Credit
This doctoral course explores the extensive literature in the economics of innovation and technological change. Restricted to doctoral students.
P. Azoulay, R. Henderson, E. Berndt

15.949 Special Seminar in Strategy
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for group study by graduate students on current topics related to strategy not otherwise included in curriculum. Consult R. M. Henderson

SPECIAL STUDIES

15.UR Undergraduate Research in Management
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

15.URG Undergraduate Studies in Management
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Participation in the work of a research group which includes such activities as independent study of the literature, direct involvement in the group’s research (commensurate with the student’s skills and preparation), or project work under an individual faculty member possibly extending over more than one term. Admission by arrangement with individual faculty member. Requires written project report.
J. S. Carroll

15.950 Special Studies in Management
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

15.951 Special Studies in Management
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Special tutorial arrangement with a faculty member for guided reading, research, laboratory, or teaching experience.
J. A. Meldman
15.952–15.959 Special Seminars in Management
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Group study of current topics related to management not otherwise included in curriculum.
15.952 is taught P/D/F.
Consult Undergraduate Program Headquarters

15.960 Special Studies in Management
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

15.961 Special Studies in Management
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
For students who desire to do advanced work or to carry out some special investigation of a management problem not specifically covered elsewhere and not qualifying as a thesis. Readings, conferences, laboratory and fieldwork, and reports. Restricted to graduate students.
Consult Sloan Educational Services

15.962–15.971 Special Seminars in Management
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

15.972–15.976 Special Seminars in Management
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

15.977 Special Seminar in Management
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

15.978 Special Seminar in Management
Prereq: 15.511
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

15.979 Special Seminar in Management
Prereq: 15.311
G (Fall, IAP, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Group study of current topics related to management not otherwise included in curriculum.
Consult Sloan Educational Services

15.980–15.985 Special Distance Learning Seminars in Management
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

15.986–15.989 Special Distance Learning Seminars in Management
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Group study through distance learning on current topics related to management.
Consult Sloan Educational Services

15.990–15.993 Special Seminars in Management
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

15.994–15.997 Special Seminars in Management
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Group study of current topics related to management not otherwise included in curriculum.
Consult Sloan Educational Services

15.999 Curricular Practical Training (CPT)
Prereq: —
G (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Students participate in off-campus work or internship experience and apply topics of management and/or culture to their experience. Requirements include mandatory attendance at one workshop and a paper. Students must have a formal employment offer prior to enrolling. Restricted to students who have been in legal F1 status for nine consecutive months and who wish to work in the United States in an area related to their field of study.
Consult Sloan Educational Services

15.99 Graduate Thesis
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Research and writing of thesis; to be arranged by the student with supervising committee.
Consult Sloan Educational Services
16.00A] Fundamentals of Engineering Design: Explore Space, Sea and Earth
(Same subject as 2.00A)
Prereq: 8.01, 18.01
U (Spring)
3-3-3
See description under subject 2.00A.

16.00 Introduction to Aerospace and Design
Prereq: —
U (Spring)
3-1-5
The fundamental concepts and approaches of aerospace engineering are highlighted through lectures on aeronautics, astronautics, and design. Active learning aerospace modules make use of information technology. Student teams are immersed in a hands-on, lighter-than-air (LTA) vehicle design project where they design, build, and fly radio-controlled LTA vehicles. The connections between theory and practice are realized in the design exercises. Required design reviews precede the LTA race competition. The performance, weight, and principle characteristics of the LTA vehicles are estimated and illustrated using physics, mathematics, and chemistry known to freshmen, the emphasis being on the application of this knowledge to aerospace engineering and design rather than on exposure to new science and mathematics. Includes exercises in written and oral communication and team building.
J. A. Hoffman

16.001 Unified Engineering I
Prereq: 8.02; 18.03 or 18.034; 3.091, 5.111, or 5.112
U (Fall)
5-1-6 REST
16.002 Unified Engineering II
Prereq: 8.02; 18.03 or 18.034; 3.091, 5.111, or 5.112
U (Fall)
5-1-6
16.001 and 16.002 require simultaneous registration. Presents fundamental principles and methods of aerospace engineering, as well as their interrelationship and applications, through lectures, recitations, design problems, and labs. Materials and structures, including statics, analysis of trusses, the analysis of statically determinate and indeterminate systems, and the stress-strain behavior of materials. Fluid mechanics, including conservation laws for fluid flows, the integral momentum theorem and applications, potential flow, vorticity and circulation, and the characterization of airfoil performance. Thermodynamics, including the thermodynamic state of a system, work, heat and various forms of energy, the first law of thermodynamics, heat engines, reversible and irreversible processes, entropy, and the second law of thermodynamics. Signals and systems, including linear and time invariant systems, convolution, and transform analysis.
W. L. Harris, J. J. Deyst, M. Drela, P. A. Lagacé, Z. S. Spakovszky, K. E. Willcox

16.003 Unified Engineering III
Prereq: 16.001 or 16.01; 16.002 or 16.02
U (Spring)
5-1-6
16.004 Unified Engineering IV
Prereq: 16.01 or 16.001; 16.02 or 16.002
U (Spring)
5-1-6
16.003 and 16.004 require simultaneous registration. Presents fundamental principles and methods of aerospace engineering, as well as their interrelationship and applications, through lectures, recitations, design problems, and labs. Materials and structures, including analysis of beam bending, buckling and torsion, material and structural failure, including plasticity, fracture, fatigue, and their physical causes. Fluid mechanics, including thin airfoil theory, three-dimensional wing theory, lifting line theory, induced drag and optimal lift distributions, wing design, aircraft performance, compressible flows, shocks, supersonic airfoils, nozzles. Thermodynamics and propulsion, including applications of the integral momentum theorem to aerospace propulsion systems, ideal and non-ideal cycle analysis, energy exchange in compressors and turbines, and an introduction to heat transfer. Applications of signals and systems to aerospace, including modulation, filtering, sampling, and navigation systems.
W. L. Harris, J. J. Deyst, M. Drela, P. A. Lagacé, Z. S. Spakovszky, K. E. Willcox

16.06 Principles of Automatic Control
Prereq: 16.004 or 16.04, 16.07
U (Fall)
3-2-7
Introduction to design of feedback control systems. Properties and advantages of feedback systems. Time-domain and frequency-domain performance measures. Stability and degree of stability. Root locus method, Nyquist criterion, frequency-domain design, and state space methods. Application to a variety of aircraft and spacecraft systems.
S. R. Hall

16.07 Dynamics
Prereq: 16.004 or 16.04, 16.06
U (Fall)
3-1-8
Fundamentals of Newtonian mechanics. Kinet- matics, particle dynamics, motion relative to accelerated reference frames, work and energy, impulse and momentum, systems of particles and rigid body dynamics. Applications to aerospace engineering including introductory topics in orbital mechanics, flight dynamics, inertial navigation and attitude dynamics.
S. E. Widnall, J. J. Deyst, E. M. Greitzer

Mechanics and Physics of Fluids

16.100 Aerodynamics
Prereq: 16.004 or 16.04
U (Fall)
3-2-7
Extends fluid mechanic concepts from Unified Engineering to aerodynamic performance of wings and bodies in sub/supersonic regimes. Subject generally has four components: subsonic potential flows, including source/vortex panel methods; viscous flows, including laminar and turbulent boundary layers; aerodynamics of airfoils and wings, including thin airfoil theory, lifting line theory, and panel method/interacting boundary layer methods; and supersonic and hypersonic airfoil theory. Material may vary
somewhat each year depending upon focus of design problem. Elementary MATLAB usage expected.

D. L. Darmofal, S. E. Widnall

16.101 Special Subject in Fluids and Propulsion
Prereq: Permission of department
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Provides credit for work on material in fluids or propulsion outside of regularly scheduled subjects. Intended for study abroad under either the department’s Year Abroad Program or the Cambridge-MIT Exchange Program. Credit may be used to satisfy specific SB degree requirements. Consult department.
M. Martínez-Sánchez

16.110 Flight Vehicle Aerodynamics
Prereq: 16.100
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8
D. L. Darmofal, M. Drela

16.120 Compressible Flow
Prereq: 2.25 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
E. M. Greitzer, W. L. Harris

16.13 Aerodynamics of Viscous Fluids
Prereq: 16.100, 16.110, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
M. Drela, D. L. Darmofal

16.198 Advanced Special Subject in Mechanics and Physics of Fluids
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
16.199 Advanced Special Subject in Mechanics and Physics of Fluids
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Organized lecture or laboratory subject consisting of material not available in regularly scheduled fluids subjects.
Consult J. Peraire

MATERIALS AND STRUCTURES

16.20 Structural Mechanics
Prereq: 16.004 or 16.04
U (Fall)
5-0-7
R. Radovitzky

16.201 Special Subject in Materials and Structures
Prereq: Permission of department
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Provides credit for work in materials and structures outside of regularly scheduled subjects. Intended for study abroad under either the department’s Year Abroad Program or the Cambridge-MIT Exchange Program. Credit may be used to satisfy specific SB degree requirements. Consult department.
M. Martínez-Sánchez

16.202 Manufacturing with Advanced Composite Materials
Prereq: —
U (Fall)
1-3-2
Introduces the methods used to manufacture parts made of advanced composite materials with work in the Technology Laboratory for Advanced Composites. Students gain hands-on experience by fabricating, machining, instrumenting, and testing graphite/epoxy specimens. Students also design, build, and test a composite structure as part of a design contest. Lectures supplement laboratory sessions with background information on the nature of composites, curing, composite machining, secondary bonding, and the testing of composites.
P. A. Lagacé

16.221J Advanced Structural Dynamics
(Same subject as 1.581J, 2.060J)
Prereq: 18.03, 1.573J
G (Fall)
3-1-8 H-LEVEL Grad Credit
See description under subject 1.581J.
E. Kausel, J. K. Vandiver

16.223 Mechanics of Heterogeneous Materials
Prereq: 16.20, 16.288J, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Mechanical behavior of heterogeneous materials such as thin-film microelectro- mechanical systems (MEMS) materials and advanced filamentary composites, with particular emphasis on laminated structural configurations. Anisotropic and crystallographic elasticity formulations. Structure, properties and mechanics of constituents such as films, substrates, active materials, fibers, and matrices including nano- and microscale constituents. Effective properties from constituent properties. Classical laminated plate theory for modeling structural behavior including extrinsic and intrinsic strains and stresses such as environmental effects. Introduction to buckling of plates and nonlinear (deformations) plate theory. Other issues in modeling heterogeneous materials such as fracture/failure of laminated structures.
B. L. Wardle
16.225j Computational Mechanics of Materials
(Same subject as 2.099j)
Prereq: Permission of instructor, programming in either C++, C, or Fortran
G (Spring)
3-3-6 H-LEVEL Grad Credit
Formulation of numerical (finite element) methods for the analysis of the nonlinear continuum response of the material. The range of material behavior considered includes finite deformation, elasticity, and inelasticity. Numerical formulation and algorithms include variational formulation and variational constitutive updates; finite element discretization; constrained problems; time discretization and convergence analysis. Strong emphasis on the parallel computer implementation of algorithms in programming assignments. The application to real engineering science are stressed throughout.
R. Radovitzky, L. J. J. Noels

16.230j Plates and Shells
(Same subject as 2.081j)
Prereq: 2.074, 2.080j, or 16.21
G (Spring)
3-0-3 H-LEVEL Grad Credit
See description under subject 2.081j.
T. Wierzbicki

16.288j Materials and Processes for Microelectromechanical Devices and Systems
(Same subject as 2.373j, 3.48j, 6.778j, 10.584j)
Prereq: 6.152J/3.155J; permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 3.48j.
L. Anand, K. F. Jensen, M. A. Schmidt, C. V. Thompson, B. L. Wardle

16.298 Advanced Special Subject in Materials and Structures
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
16.299 Advanced Special Subject in Materials and Structures
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Organized lecture or laboratory subject consisting of material not available in regularly scheduled materials and structures subjects.
Consult J. Peraire

INFORMATION AND CONTROL ENGINEERING

16.30 Estimation and Control of Aerospace Systems
Prereq: 16.06, 16.060, 2.010, or 6.302
U (Spring)
3-0-9
Design of control systems using frequency domain and state space techniques. Control law design using Nyquist diagrams and Bode plots. State feedback, state estimation, and the design of dynamic control laws. Elementary analysis of nonlinearities and their impact on control design. Extensive use of computer-aided control design tools. Applications to various aerospace systems including navigation, guidance, and control of vehicles.

16.301 Special Subject in Control, Dynamics and Automation
Prereq: Permission of department
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Provides credit for work on material in control and/or dynamics and/or automation outside of regularly scheduled subjects. Intended for study abroad under either the department's Year Abroad Program or the Cambridge-MIT Exchange Program. Credit may be used to satisfy specific SB degree requirements. Consult department.
M. Martinez-Sanchez

16.31 Feedback Control Systems
Prereq: 16.06 or 16.060
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to the state-space approach to control system analysis and control synthesis. State-space representation of dynamic systems; controllability and observability; state-space realizations of transfer functions; and canonical forms. Design of controllers using state-space methods, including pole placement and optimal control methods. Introduction to the Kalman filter. Limitations on performance of control systems from classical and state-space perspectives. Introduction to robustness of multivariable control systems, using frequency domain techniques.
J. P. How

16.322 Stochastic Estimation and Control
Prereq: 16.06 or 16.060, 6.401, or 6.431
G (Fall)
3-0-9 H-LEVEL Grad Credit
G. Schmidt

16.323 Principles of Optimal Control
Prereq: 18.085
G (Spring)
3-0-9 H-LEVEL Grad Credit
Studies the principles of deterministic optimal control. Variational calculus and Pontryagin's maximum principle. Applications of the theory, including optimal feedback control, time-optimal control, and others. Dynamic programming and numerical search algorithms introduced briefly.
J. P. How

16.324 Advanced Estimation for GPS and Inertial Navigation
Prereq: 16.322
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Review of stochastic processes, static estimation, recursive estimation, and dynamic systems with noise. Discrete and continuous Kalman filters, smoothing, and extended Kalman filters. GPS, inertial sensors, parity space hypothesis testing, and Markov models. Various applications of estimation methods to aerospace systems.
J. P. How, J. J. Deyst

16.333 Aircraft Stability and Control
Prereq: 16.31 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
V/STOL stability, dynamics, and control during
transition from hover to forward flight. Parameter sensitivity and handling quality analysis of aircraft through variable flight conditions. Brief discussion of motion at high angles-of-attack, roll coupling, and other nonlinear flight regimes.

J. P. How

16.335 Spacecraft Dynamics and Control
Prereq: 16.06 or 16.060
G (Spring)
3-0-9 H-LEVEL Grad Credit

Review of rigid body kinematics and dynamics for small and large rotations. Attitude sensors and actuators and the attitude guidance and control problem. Open-loop stability analyses are developed for a variety of equilibrium conditions. Spinners, dual spinners, gravity gradient, and geomagnetic torques. Momentum exchange and mass expulsion devices. Figure control of mirrors, linear control for pitch and coupled roll/yaw motion, and active nutation damping. Orbit attitude coupling in spacecraft dynamics. Stabilization and distributed control of deforming reflectors. Effects of fuel slosh and structural flexibility briefly covered.

R. V. Ramnath

16.337J Dynamics of Nonlinear Systems
(Same subject as 6.243J)
Prereq: 18.100, 6.241
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

See description under subject 6.243J.

J. L. Wyatt, Jr., A. Megretski, M. Dahleh, R. Ramnath

16.343 Spacecraft and Aircraft Sensors and Instrumentation
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Covers fundamental sensor and instrumentation principles in the context of systems designed for space or atmospheric flight. Systems discussed include basic measurement system for force, temperature, pressure; navigation systems (Global Positioning System, Inertial Reference Systems, radio navigation), air data systems, communication systems; spacecraft attitude determination by stellar, solar, and horizon sensing; remote sensing by incoherent and Doppler radar, radiometry, spectrometry, and interferometry. Also included is a review of basic electromagnetic theory and antenna design and discussion of design considerations for flight. Alternate years.

R. J. Hansman, D. W. Miller

16.346 Astrodynamics
Prereq: 18.03
G (Fall)
3-0-9 H-LEVEL Grad Credit

Fundamentals of astrodynamics; the two-body orbital initial-value and boundary-value problems with applications to space vehicle navigation and guidance for lunar and planetary missions with applications to space vehicle navigation and guidance for lunar and planetary missions including both powered flight and midcourse maneuvers. Topics include celestial mechanics, Lambert’s problem, orbit determination, multi-body methods, mission planning, and recursive algorithms for space navigation. Selected applications from the Apollo, Space Shuttle, and Mars exploration programs.

R. H. Battin

16.35 Real-Time Systems and Software
Prereq: 16.04 or 1.00
U (Spring)
3-0-9

Concepts, principles, and methods for specifying and designing real-time computer systems. Topics include operating system architecture, process management, concurrency, networking, scheduling, execution time analysis, real-time features of operating systems and software engineering concepts.

N. Roy

(Same subject as ESD.355J)
Prereq: 16.35, 16.880J/ESD.33J, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

A reading and discussion subject on issues in the engineering of software systems and software development project design. Includes the present state of software engineering, what has been tried in the past, what worked, what did not, and why. Topics may differ in each offering, but are chosen from the software process and lifecycle; requirements and specifications; design principles; testing, formal analysis, and reviews; quality management and assessment; product and process metrics; COTS and reuse; evolution and maintenance; team organization and people management; and software engineering aspects of programming languages.

N. G. Leveson

16.36 Communication Systems Engineering
Prereq: 16.004, 16.04, or 6.003; 6.041
U (Spring)
3-0-9

Introduces the fundamentals of digital communications and networking. Topics include elements of information theory, sampling and quantization, coding, modulation, signal detection and system performance in the presence of noise. Study of data networking includes multiple access, reliable packet transmission, routing and protocols of the internet. Concepts discussed in the context of aerospace communication systems: aircraft communications, satellite communications, and deep space communications.

E. H. Modiano

16.37J Data-Communication Networks
(Same subject as 6.263J)
Prereq: 6.041 or 18.313
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 6.263J.

D. P. Bertsekas, E. Modiano

16.391J Statistics for Engineers and Scientists
(Same subject as 6.434J)
Prereq: 18.02, 18.06, 6.431, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 6.434J.

M. Win, J. N. Tsitsiklis

16.395 Principles of Wide Bandwidth Communication (New)
Prereq: A strong background in digital communication, e.g. 6.011, 16.36, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Introduction to the principles of wide bandwidth wireless communication, with a focus on ultra-wide bandwidth (UWB) systems. Topics include the basics of spread-spectrum systems, impulse radio, Rake reception, transmitted reference signaling, spectral analysis, coexistence issues, signal acquisition, channel measurement and modeling, regulatory issues, and ranging, localization and GPS. Consists of lectures and technical presentations by students.

M. Z. Win
16.398 Advanced Special Subject in Information and Control
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
16.399 Advanced Special Subject in Information and Control
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Organized lecture or laboratory subject consisting of material not available in regularly scheduled subjects.
Consult J. Peraire

HUMANS AND AUTOMATION

16.400 Human Factors Engineering
(Subject meets with 16.453)
Prereq: 16.06
U (Fall)
3-3-6
M. L. Cummings, L. R. Young

16.401 Special Subject in Communication and Software
Prereq: Permission of department
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Provides credit for student work on undergraduate-level material in communications and/or software outside of regularly scheduled subjects. Intended for study abroad under either the department’s Year Abroad Program or the Cambridge-MIT Exchange Program. Credit may be used to satisfy specific SB degree requirements. Consult department.
M. Martínez-Sánchez

16.410 Principles of Autonomy and Decision Making
(Subject meets with 16.413)
Prereq: 1.00, 6.001, or 16.04; 6.041 or 6.042
U (Fall)
3-0-9
Survey of reasoning, optimization and decision making methodologies for creating highly autonomous systems and decision support aids. Focus on principles, algorithms, and their application, taken from the disciplines of artificial intelligence and operations research. Reasoning paradigms include logic and deduction, heuristic and constraint-based search, model-based reasoning, planning and execution, and machine learning. Optimization paradigms include linear programming, integer programming, and dynamic programming. Decision-making paradigms include decision theoretic planning, and Markov decision processes.
B. C. Williams, E. Frazzoli

16.412J Cognitive Robotics
(Same subject as 6.834J)
Prereq: 6.041 or 6.042; and 16.410, 16.413, 6.034, or 6.825
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Algorithms and paradigms for creating a wide range of robotic systems that act intelligently and robustly, by reasoning extensively from models of themselves and their world. Examples range from autonomous Mars explorers and cooperative air vehicles, to everyday embedded devices. Topics include deduction and search in real-time; temporal, decision-theoretic and contingency planning; dynamic execution and re-planning; reasoning about hidden state and failures; reasoning under uncertainty, path planning, mapping and localization, and cooperative and distributed robotics. 8 Engineering Design Points.
B. C. Williams, R. Davis

16.413 Principles of Autonomy and Decision Making
(Subject meets with 16.410)
Prereq: 1.00, 6.001, or 16.04; 6.041 or 6.042
G (Fall)
3-0-9 H-LEVEL Grad Credit
Graduate-level version of 16.410; see description under 16.410. Additional material on reasoning under uncertainty and machine learning, including hidden Markov models, graphical models and Bayesian networks, computational learning theory, reinforcement learning, decision tree learning and support vector machines. Assignments include the application of autonomy algorithms to practical aerospace systems, as well as more advanced programming assignments.
B. C. Williams, E. Frazzoli

16.415J Robotics: Science and Systems I (New)
(Same subject as 6.141J)
Prereq: Permission of instructor
U (Spring)
2-6-4 Institute LAB
See description under subject 6.141J.
J. Leonard, O. R’Reilly, N. Roy, D. Rus, S. Teller

16.416J Robotics: Science and Systems II (New)
(Same subject as 6.142J)
Prereq: 6.141 or permission of instructor
U (Fall)
2-6-4
See description under subject 6.142J.
J. Leonard, O. R’Reilly, N. Roy, D. Rus, S. Teller

16.422 Human Supervisory Control of Automated Systems
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit
Principles of supervisory control and telerobotics. Different levels of automation are discussed, as well as the allocation of roles and authority between humans and machines. Human-vehicle interface design in highly automated systems. Decision aiding. Trade-offs between human control and human monitoring. Automated alerting systems and human intervention in automatic operation. Enhanced human interface technologies such as virtual presence. Performance, optimization, and social implications of the human-automation system. Examples from aerospace, ground, and undersea vehicles, robotics, and industrial systems. Alternate years.
M. L. Cummings

16.423J Aerospace Biomedical and Life Support Engineering
(Same subject as ESD.65J, HST.515J)
Prereq: 16.400, 16.06, 16.060, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit
Fundamentals of human performance, physiology, and life support impacting engineering design and aerospace systems. Topics include effects of gravity on the muscle, skeletal, cardiovascular, and neurovestibular systems; human/pilot modeling and human/machine design; flight experiment design; and life support
engineering for extravehicular activity (EVA). Case studies of current research are presented. Assignments include a design project, quantitative homework sets, and quizzes emphasizing engineering and systems aspects.

D. J. Newman

16.430J Sensory-Neural Systems: Spatial Orientation from End Organs to Behavior and Adaptation
(Alchemy subject as HST.514J)
Prereq: Neuroscience or systems engineering or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject HST.514J.
L. Young, C. Oman, D. Merfeld, R. Lewis, C. Wall, L. Zupon

16.431J Flight Simulation and Virtual Environments
Prereq: 18.03, 16.06, or 16.060
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-6-3 H-LEVEL Grad Credit
Simulation of aircraft for research and pilot training. Coordinate transformations, flight dynamics, and conversion of equations of motion into a digital computer model. Cockpit motion requirements, motion washout, artificial control, and feel and high-g cueing devices. Principles of vision and implementation of display systems, including head-mounted displays. Computer graphics, rendering, texture, lighting, and visual effects. Term lab project developing a vehicle simulation. Alternate years.

Staff

16.453 Human Factors Engineering
(Subject meets with 16.400)
Prereq: 16.06 or 2.010
G (Fall)
3-1-8 H-LEVEL Grad Credit
Requires a term project. See description under subject 16.400.

M. L. Cummings, L. R. Young

16.456J Biomedical Signal and Image Processing
(Alchemy subject as 6.555J, HST.582J)
Prereq: 6.003, 2.004, 16.004, or 18.085
G (Spring)
3-6-3 H-LEVEL Grad Credit
See description under subject HST.582J.

16.459 Bioengineering Journal Article Seminar
Prereq: —
G (Fall, Spring)
0-2-0
Can be repeated for credit
Each term, the class selects a new set of professional journal articles on bioengineering topics of current research interest. Some papers are chosen because of particular content, others are selected because they illustrate important points of methodology. Each week, one student leads the discussion, evaluating the strengths, weaknesses, and importance of each paper. Subject may be repeated for credit a maximum of four terms. Letter grade given in the last term applies to all accumulated units of 16.459.

C. M. Oman, L. R. Young

16.470J Statistical Methods in Experimental Design
(Alchemy subject as ESD.756J)
Prereq: 6.041 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Statistically based experimental design inclusive of forming hypotheses, planning and conducting experiments, analyzing data, and interpreting and communicating results. Topics include descriptive statistics, statistical inference, hypothesis testing, parametric and nonparametric statistical analyses, factorial ANOVA, randomized block designs, MANOVA, linear regression, repeated measures models, and application of statistical software packages. Alternate years.

M. L. Cummings

16.498 Advanced Special Subject in Humans and Automation
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

16.499 Advanced Special Subject in Humans and Automation
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Organized lecture or laboratory subject consisting of material not available in regularly scheduled subjects.
Consult J. Peraire

PROPELs AND ENERGY CONVERSION

16.50 Introduction to Propulsion Systems
Prereq: 16.004 or 16.05
U (Spring)
3-0-9
Presents aerospace propulsion devices as systems, with functional requirements and engineering and environmental limitations. Requirements and limitations that constrain design choices. Both air-breathing and rocket engines covered, at a level which enables rational integration of the propulsive system into an overall vehicle design. Mission analysis, fundamental performance relations, and exemplary design solutions presented.

A. H. Epstein, Staff

16.511 Aircraft Engines and Gas Turbines
Prereq: 16.50 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Performance and characteristics of aircraft engines and industrial gas turbines, as determined by thermodynamic and fluid mechanic behavior of components: inlets, compressors, combustors, turbines, and nozzles. Discusses various engine types, including turbopet, turbofan, and turboprop. Limitations imposed by material properties and stresses. Emphasizes future design trends, including reduction noise, pollutant formation, fuel consumption, and weight.

A. H. Epstein

16.512 Rocket Propulsion
Prereq: 16.50 or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

P. C. Lozano

16.522 Space Propulsion
Prereq: 16.512, 8.03
G (Spring)
3-0-9 H-LEVEL Grad Credit
Reviews rocket propulsion fundamentals. Discusses advanced concepts in rocket propulsion ranging from chemical engines to electrical en-
16.540 Internal Flows in Turbomachines
Prereq: 2.25 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Internal fluid motions in turbomachines, propulsion systems, ducts and channels, and other fluid machinery. Useful basic ideas, fundamentals of rotational flows, loss sources and loss accounting in fluid devices, unsteady internal flow and flow instability, flow in rotating passages, swirling flow, generation of streamwise vorticity and three-dimensional flow, non-uniform flow in fluid components. Alternate years.

E. M. Greitzer, Z. S. Spakovszky

16.543 An Introduction to Acoustics of Fluid Flow
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Fundamentals of acoustics and aerodynamic sound with application to external and internal flows, Lighthill’s acoustic analogy, effect of solid surfaces on acoustic behavior, effect of uniform and non-uniform mean flow, physics of jet noise, trailing edge noise theory, solutions to entropy, vorticity and acoustic field equations, characterization and estimation of noise sources encountered in turbomachinery and aircraft applications, innovative approaches to aircraft noise reduction.

Z. Spakovszky

16.55 Ionized Gases
Prereq: 8.03
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit


M. Martínez-Sánchez

16.58 Aircraft Gas Turbine Structures
Prereq: 16.511 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines the structural design of aircraft gas turbine engines as set by the (multidisciplinary) coupling between aerodynamic, thermal, and structural requirements for high-performance propulsion systems. Topics include structures under static loads, rotor dynamics and vibration (design of rotating blades and disks, critical speed of rotating shafts, flutter and forced response of compressor and turbine blades), low-cycle fatigue, and design considerations for hot-section components used in gas turbine engines. Alternate years.

A. H. Epstein, F. Ehrich, J. I. Hsia

16.598 Advanced Special Subject in Propulsion and Energy Conversion
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

16.599 Advanced Special Subject in Propulsion and Energy Conversion
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Organized lecture or laboratory subject consisting of material not available in regularly scheduled subjects.

Consult J. Peraire

OTHER UNDERGRADUATE SUBJECTS

16.UR Undergraduate Research
Prereq: —
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

16.URG Undergraduate Research
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

Undergraduate research opportunities in aeronautics and astronautics. For further information, contact Manuel Martínez-Sánchez, departmental coordinator.

M. Martínez-Sánchez

16.EPE Summer Practice Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPE, 2.EPE, 3.EPE, 10.EPE, 16.EPE, 22.EPE)
Prereq: 2.EPW or permission of instructor
U (Fall, Spring)
0-0-3 [P/D/F]
Can be repeated for credit

See description under subject 2.EPE.

D. K. P. Yue

16.EPR Reflective Learning Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPR, 2.EPR, 3.EPR, 10.EPR, 16.EPR, 22.EPR)
Prereq: 2.EPE or permission of instructor
U (Fall)
0-0-3 [P/D/F]
See description under subject 2.EPR.

D. K. P. Yue

16.EPW Summer Practice Workshop
Engineering School-Wide Elective Subject.
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW, 10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]

See description under subject 2.EPW.

D. K. P. Yue

16.621 Experimental Projects I
Prereq: 16.06, 16.07
U (Fall, Spring)
2-1-3

First part of a two-term sequence addresses the conception and design of a student-selected experimental project carried out by a team. Principles of project hypothesis formulation and assessment, experimental measurements and error analysis, and effective report writing and oral presentation, with instruction both in-class and on an individual team basis. Selection and detailed planning of a research project, including in-depth design of components and equipment. Preparation of a detailed proposal for the selected project, which is then carried through to completion in 16.622.

I. A. Woltz, J. L. Craig

16.622 Experimental Projects II
Prereq: 16.621, 6.041
U (Fall, Spring)
1-7-4 Institute LAB

Execution of project experiments based on the designs developed in 16.621. Students construct their defined experiment, carry out...
experimental measurements of the relevant phenomena, analyze the data, and then apply the results to assess the hypothesis they developed previously. Written final report on the entire project and formal oral presentation. Includes instructions on effective report writing and oral presentation.

I. A. Waltz, J. L. Craig, R. F. Perdichizzi

16.64 Flight Measurement Laboratory
Prereq: 16.02 or 16.020
U (Spring)
2-2-2
Opportunity to see aeronautical theory applied in real-world environment of flight. Students assist in design and execution of simple engineering flight experiments in light aircraft. Typical investigations include determination of stability derivatives, verification of performance specifications, and measurement of navigation system characteristics. Restricted to students in Aeronautics and Astronautics.

R. J. Hansman

16.652 Inventions and Patents
Engineering School-Wide Elective Subject. (Offered under: 3.172, 6.901, 16.652)
Prereq: 14.02
U (Fall)
3-0-6
See description under subject 3.172.

R. H. Rines

16.653 Management in Engineering
Engineering School-Wide Elective Subject. (Offered under: 2.96, 16.653)
(Subject meets with 2.961, 6.930J, 10.806J)
Prereq: —
U (Fall)
3-1-8
See description under subject 2.96.

A. V. d’Arbeloff, J.-H. Chun

16.680 Undergraduate Special Project
Prereq: —
U (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Opportunity to work on projects related to aerospace engineering outside the department. Consult department’s Academic Programs Office.

M. Martínez-Sánchez

16.681 Special Projects
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Study or laboratory project work by qualified students. Topics selected in consultation with the instructor.

M. Martínez-Sánchez

16.682 Selected Topics in Aeronautics and Astronautics
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Study by qualified students. Topics selected in consultation with the instructor.

M. Martínez-Sánchez

16.683 Aeronautics and Astronautics Seminars
Prereq: —
U (Fall, Spring)
2-0-0 [P/D/F]
Can be repeated for credit
Speakers from campus and industry discuss current activities and advances in aeronautics and astronautics. Restricted to Course 16 students.

M. Martínez-Sánchez

FLIGHT TRANSPORTATION

16.71J The Airline Industry
(Same subject as 1.232J, 15.054J, ESD.217J)
Prereq: —
G (Fall)
3-0-9
Overview of the global airline industry, focusing on recent industry performance, current issues and challenges for the future. Fundamentals of airline industry structure, airline economics, operations planning, safety, labor relations, airports and air traffic control, marketing, and competitive strategies, with an emphasis on the interrelationships among major industry stakeholders. Recent research findings of the MIT Global Airline Industry Program are showcased, including the impacts of congestion and delays, evolution of information technologies, changing human resource management practices, and competitive effects of new entrant airlines. Taught by faculty participants of the Global Airline Industry Program.


16.72 Air Traffic Control
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduces the various aspects of present and future Air Traffic Control systems. Descriptions of the present system: systems-analysis approach to problems of capacity and safety; surveillance, including NAS and ARTS; navigation subsystem technology; aircraft guidance and control; communications; collision avoidance systems; sequencing and spacing in terminal areas; future directions and development; critical discussion of past proposals and of probable future problem areas. Requires term paper.

R. J. Hansman

16.75J Airline Management
(Same subject as 1.234J)
Prereq: 16.71J
G (Spring)
3-0-9 H-LEVEL Grad Credit
Overview of airline management decision processes, with a focus on economic issues and their relationship to operations planning models and decision support tools. Application of economic models of demand, pricing, costs, and supply to airline markets and networks. Examination of industry practice and emerging methods for fleet planning, route network design, scheduling, pricing and revenue management, with emphasis on the interactions between the components of airline management and profit objectives in competitive environments. Students participate in a competitive airline management simulation game as part of the subject requirements.

P. P. Belobaba

16.76J Logistical and Transportation Planning Methods
(Same subject as 1.203J, 6.281J, 15.073J, ESD.216J)
Prereq: 6.431
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.203J.

R. C. Larson, A. R. Odoni, A. I. Barnett
AEROSPACE SYSTEMS

16.77j Airline Schedule Planning
(Same subject as 1.206j, ESD.215j)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.206j.
C. Barnhart

16.781j Planning and Design of Airport Systems
(Same subject as 1.231j, ESD.224j)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 1.231j.
R. de Neufville, A. R. Odoni

16.798 Advanced Special Subject in Flight Transportation
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
16.799 Advanced Special Subject in Flight Transportation
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Organized lecture or laboratory subject consisting of material not available in regularly scheduled subjects.
Consult J. Peraire

16.810j Engineering Design and Rapid Prototyping
(Same subject as ESD.035j)
Prereq: 16.01, 16.02 or 2.001, 2.002 or permission of instructor
U (IAP)
2-4-0
Develops initial competency in engineering design by taking a holistic view. Conceiving, designing, manufacturing and testing a system component such as a complex structural part. Activities include hand sketching, CAD modeling, CAE analysis, CAM programming, and operation of CNC machining equipment. Focuses on the complementary roles of human creativity as well as the design process itself. Designs are executed by pairs of students who enter their products in a design competition. Enrollment may be limited.
D. de Weck

16.812 The Aerospace Industry
Prereq: 16.04
U (Spring)
2-0-4
Covers the evolution of the aerospace industry and explores current events with the aim of preparing students for summer internships and post-baccalaureate plans. Readings from Lean Enterprise Value: Insights from MIT’s Lean Aerospace Initiative, Aviation Week & Space Technology, and comments from invited experts form the basis for class discussions. Enrollment limited to 20 students.
R. B. Lewis, J. L. Craig, B. B. Lechner

16.82 Flight Vehicle Engineering
Prereq: Permission of department
U (Fall)
3-3-6
Design of an atmospheric flight vehicle to satisfy stated performance, stability, and control requirements. Emphasizes individual initiative, application of fundamental principles, and the compromises inherent in the engineering design process. Includes instruction and practice in written and oral communication, through team presentations and a written final report. Enrollment restricted to seniors in Course 16 who have satisfactorily completed all other departmental requirements for the SB degree, or by permission of instructor.
R. J. Hansman, J. E. Keesee

16.821 Flight Vehicle Development
Prereq: 16.82
Acad Year 2007–2008: U (IAP, Spring)
Acad Year 2008–2009: Not offered
2-10-6 Institute LAB
Implementation and operation of a flight system. Extension of the 16.82 project in the previous term. Emphasis is on system integration, implementation, and performance verification using methods of experimental inquiry. Includes refinement of subsystem designs and fabrication of working prototypes. Experimental analysis of subsystem performance and comparison with physical models of performance developed in 16.82 and design goals. Component integration into the full system, with detailed analysis and operation of the complete vehicle in the laboratory and in-the-field. Communication skills are honed through written and oral reports. Formal reviews of the overall system design will be performed. Principles of laboratory safety.
D. W. Miller, J. E. Keesee

16.83 Space Systems Engineering
Prereq: Permission of department
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-3-6
Design of a complete space system, including systems analysis, trajectory analysis, entry dynamics, propulsion and power systems, structural design, avionics, thermal and environmental control, human factors, support systems, and weight and cost estimates. Students participate in teams, each responsible for an integrated vehicle design, providing experience in project organization and interaction between disciplines. Includes several aspects of team communication including three formal presentations, informal progress reports, colleague assessments, and written reports. Every other year, 16.83 is the first term in the three-term capstone subject, followed by 16.831 and 16.832. Can be taken alone.
D. W. Miller, J. E. Keesee

16.831 Space Systems Development I
Prereq: 16.83
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
2-6-4 1/2 Institute LAB
Students build the space system designed during the previous term in 16.83. Sub-system designs are refined and full-scale prototypes are fabricated. Sub-systems are integrated into a vehicle and tested. Sub-system performance is verified using methods of experimental inquiry, and is compared with physical models of performance developed in 16.83, and with design goals. Communication skills are honed through written and oral reports. Formal reviews include the Implementation Plan Review and the Acceptance Review. Alternate years.
D. W. Miller, J. Keesee

16.832 Space Systems Development II
Prereq: 16.831
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
1-5-0 1/2 Institute LAB
Students operate the space system built during the previous term in 16.831. Modifications based upon first vehicle testing are implemented. Remaining vehicles and system elements are fabricated. System is operated in the laboratory as well as in the field. Overall system performance is verified using methods of experimental inquiry, and compared with physical models. Alternate years.
D. W. Miller, J. Keesee
16.851 Satellite Engineering
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Fundamentals of satellite engineering design, including distributed satellite. Studies orbital environment. Analyzes problems of station keeping, attitude control, communications, power generation, structural design, thermal balance, and subsystem integration. Considers trade-offs among weight, efficiency, cost, and reliability. Discusses choice of design parameters, such as size, weight, power levels, temperature limits, frequency, and bandwidth. Examples taken from current satellite systems.
J. Keese, D. W. Miller

16.852J Integrating The Lean Enterprise
(Same subject as ESD.61J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Addresses some of the important issues involved with the planning, development, and implementation of lean enterprises. People, technology, process, and management dimensions of an effective lean manufacturing company are considered in a unified framework. Particular emphasis on the integration of these dimensions across the entire enterprise, including product development, production, and the extended supply chain. Analysis tools as well as future trends and directions are explored. A key component of this subject is a team project.
D. Nightingale

16.855J Enterprise Architecting
(Same subject as ESD.38J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.38J.
D. Nightingale, D. Rhodes

16.861 Engineering Systems Analysis for Design
Engineering School-Wide Elective Subject.
(Offered under: 1.146, 3.56, 16.861, ESD.71)
Prereq: 1.145 or permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject ESD.71.
R. de Neufville

16.862 Engineering Risk-Benefit Analysis
Engineering School-Wide Elective Subject.
(Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject ESD.72.
G. E. Apostolakis

16.863J System Safety
(Same subject as ESD.863J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Covers important concepts and techniques in designing and operating safety-critical systems. Topics include the nature of risk, formal accident and human error models, causes of accidents, fundamental concepts of system safety engineering, system and software hazard analysis, designing for safety, fault tolerance, safety issues in the design of human-machine interaction, verification of safety, creating a safety culture, and management of safety-critical projects. Includes a class project involving the high-level system design and analysis of a safety-critical system.
N. G. Leveson

16.865J Aircraft Systems Engineering
(Same subject as ESD.35J)
Prereq: Permission of instructor
Acad Year 2008–2009: Not offered
Acad Year 2008–2009: 3-1-8 H-LEVEL Grad Credit
Holistic view of the aircraft as a system, covering basic systems engineering; cost and weight estimation; basic aircraft performance; safety and reliability; life cycle topics; aircraft subsystems; risk analysis and management; and system realization. Small student teams retrospectively analyze an existing aircraft covering: key design drivers and decisions; aircraft attributes and subsystems; operational experience. Oral and written versions of the case study are delivered. Focuses on a systems engineering analysis of the Space Shuttle. Study both design and operations of the shuttle, with frequent lectures by outside experts. Students choose specific shuttle systems for detailed analysis and develop new subsystem designs using state of the art technology.
R. J. Hansman, A. Haggerty, R. Liebeck

16.886 Air Transportation Systems Architecting
Prereq: 16.885 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-2-7 H-LEVEL Grad Credit
Addresses the architecting of air transportation systems. Focuses on the conceptual phase of product definition including technical, economic, market, environmental, regulatory, legal, manufacturing, and societal factors. Centers on a realistic system case study and includes a number of lectures from industry and government. Past examples include the Very Large Transport Aircraft, a Supersonic Business Jet and a Next Generation Cargo System. Identifies the critical system level issues and analyzes them in depth via student team projects and individual assignments. Overall goal is to produce a business plan and a system specifications document that can be used to assess candidate systems.
R. J. Hansman, A. Haggerty, R. Liebeck

16.887J Multidisciplinary System Design Optimization
(Same subject as ESD.77J)
Prereq: 18.085 or permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject ESD.77J.
O. de Weck, K.E. Wilcox

16.889J Space Systems Engineering
(Same subject as ESD.352J)
Prereq: 16.851, 16.892, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
4-6-2 H-LEVEL Grad Credit
Focus on developing space system architectures. Applies subsystem knowledge gained in 16.851 to examine interactions between subsystems in the context of a space system design. Principles and processes of systems engineering including developing space architectures, developing and writing requirements, and concepts of risk are explored and applied to the project. Subject develops, documents, and presents a conceptual design of a space system including a preliminary spacecraft design.
E. F. Crawley, J. A. Hoffman
16.891J Space Policy Seminar
(Same subject as ESD.129J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
2-0-7 H-LEVEL Grad Credit

Explores current issues in space policy as well as the historical roots for the issues. Emphasis on critical policy discussion combined with serious technical analysis. Covers national security space policy, civil space policy, as well as commercial space policy. Issues explored include the GPS dilemma, the International Space Station choices, commercial launch from foreign countries, and the fate of satellite-based cellular systems.

J. A. Hoffman

16.892J Space System Architecture and Design
(Same subject as ESD.353J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-7 H-LEVEL Grad Credit

Lectures, readings, and discussion on topics in the architecture and design of space systems. Reviews existing space system architectures and the classical methods of designing them. Focuses on use of multiattribute utility theory as a new design paradigm for the space systems when combined with integrated concurrent engineering and efficient searches of large architectural tradespaces. Considers topics such as design of flexibility into the architecture, resolution of uncertainty (technical, economic, etc.) in the architectures and the integration with policy issues and product development issues. Prepares students for 16.89.

D. E. Hastings

16.895 J Space policy Seminar
Prereq: Permission of instructor
G (Spring)
Prepares students for 16.89.
Policy issues and product development issues.

D. E. Hastings

16.898 Advanced Special Subject in Aerospace Systems
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

16.899 Advanced Special Subject in Aerospace Systems
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Organized lecture or laboratory subject consisting of material not available in regularly scheduled subjects.

Consult J. Peraire

16.90 Computational Methods in Aerospace Engineering
(16.901)
Prereq: 16.004 or 16.04; 6.041 or 16.022 or 16.051; or permission of instructor
U (Spring)
3-0-9

Introduction to computational techniques arising in aerospace engineering. Techniques include numerical integration of systems of ordinary differential equations; numerical discretization of partial differential equations; and probabilistic methods for quantifying the impact of variability. Specific emphasis will be given to finite volume methods in fluid mechanics, and energy and finite element methods in structural mechanics.

K. E. Willcox, D. L. Darmofal, R. Radovitzky

COMPUTATION

16.910 Introduction to Numerical Simulation
(Same subject as 2.096J, 6.336J)
Prereq: 18.03 or 18.06
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 6.336J.


16.920J Numerical Methods for Partial Differential Equations
(Same subject as 2.097J, 6.339J)
Prereq: 18.03 or 18.06
G (Fall)
3-0-9 H-LEVEL Grad Credit

Covers the fundamentals of modern numerical techniques for a wide range of linear and nonlinear elliptic, parabolic, and hyperbolic partial differential and integral equations. Topics include mathematical formulations; finite difference, finite volume, finite element, and boundary element discretization methods; and direct and iterative solution techniques. The methodologies described form the foundation for computational approaches to engineering systems involving heat transfer, solid mechanics, fluid dynamics, and electromagnetics. Computer assignments requiring programming.

D. L. Darmofal, A. T. Patera, J. K. White

16.930 Advanced Topics in Numerical Methods for Partial Differential Equations
Prereq: 16.920
G (Spring)
3-0-9 H-LEVEL Grad Credit

Covers advanced topics in numerical methods for the discretization, solution, and control of problems governed by partial differential equations. Topics include the application of the finite element method to systems of equations with emphasis on equations governing compressible, viscous flows; grid generation; optimal control of PDE-constrained systems; a posteriori error estimation and adaptivity; reduced basis approximations and reduced-order modeling. Computer assignments require programming.

D. L. Darmofal, A. T. Patera

16.940J Computational Geometry
(Same subject as 1.128J, 2.089J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 2.089J.

N. M. Patrikalakis, D. C. Gossard

16.948 Advanced Special Subject in Computation
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

16.949 Advanced Special Subject in Computation
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Organized lecture or laboratory subject consisting of material not available in regularly scheduled subjects.

Consult J. Peraire
**OTHER GRADUATE SUBJECTS**

16.980 Advanced Special Project
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

16.981 Advanced Special Project
Prereq: Permission of department
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Study, original investigation, or lab project work by qualified students. Topics selected in consultation with instructor. Consult J. Peraire

16.982 Advanced Special Subject
Prereq: Permission of department
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

16.983 Advanced Special Subject
Prereq: —
G (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Organized lecture or laboratory subject consisting of material not available in regularly scheduled subjects. Consult J. Peraire

16.984 Seminar
Prereq: —
G (Fall, Spring)
2-0-0 [P/D/F]
Can be repeated for credit

Discussion of current interest topics by staff and guest speakers. Restricted to Course 16 students. M. Martínez-Sánchez

16.985J Proseminar in Manufacturing
(Same subject as 2.890J, 3.80J, 10.792J, 15.792J)
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

See description under subject 15.792J. D. B. Rosenfield

16.999 Teaching Fellows Seminar
Prereq: Permission of instructor
G (Fall, IAP)
Units arranged [P/D/F]

Explore various aspects of teaching and learning through directed and follow-up reading, open dialogue, teaching practice and sharing of issues, concerns, and associated approaches. Topics include course planning and preparation, writing homework assignments and exams, assessment techniques of students and teaching, technology and teaching, working with students one-on-one, types/styles of teaching and learning, learning theories and cognitive development, and ethics and cheating. In-depth exploration of a topic chosen by each student through further reading, reflection, and possible application, and associated sharing and teaching with the class. Consult P. A. Lagacé
17.000J Political Philosophy
(Same subject as 24.611J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Systematic examination of selected issues in political philosophy. Topic changes each year and subject may be taken repeatedly with permission of instructor.
V. Mehta

17.006J Feminist Political Thought
(Subject meets with 17.007J, 24.237, SP.601J)
Prereq: Permission of instructor, based on previous coursework
G (Fall)
3-0-9 H-LEVEL Grad Credit
17.007J Feminist Political Thought
(Same subject as SP.601J)
(Subject meets with 17.006, 24.237)
Prereq: —
U (Spring)
3-0-9 HASS
See description under subject SP.601J.
E. Wood

17.01J Justice
(Same subject as 24.04J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H
See description under subject 24.04J.
V. Mehta

17.021J Philosophy of Law
(Same subject as 24.235J)
Prereq: One Philosophy subject
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
See description under subject 24.235J.
Staff

17.03 Introduction to Political Thought
Prereq: —
U (Fall)
3-0-9 HASS
Examines major texts in the history of political thought and considers how they contribute to a broader conversation about freedom, equality, democracy, rights, and the role of politics in human life. Philosophers include Plato, Aristotle, Machiavelli, Hobbes, Locke, Rousseau, Marx, Tocqueville, and Mill.

17.045J Power: Interpersonal, Organizational and Global Dimensions
(Same subject as 21A.245J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
See description under subject 21A.245J.
S. Silbey

17.10 International Political Economy (New)
Prereq: —
U (Spring)
3-0-9 HASS
Provides an introduction to the politics of international economic relations. Government decision-making in areas such as trade policy, exchange rates, and financial flows are influenced not only by economic factors, but also by political processes within and among countries. Overview of a number of analytical ‘lenses’ to view the global economy. Examines the politics of trade policy, international monetary and financial relations, foreign direct investment, third-world development and transition economies, and the debate over “globalization.”
D. Singer

17.100J Political Economy I: Theories of the State and the Economy
(Same subject as 14.781J, 15.678I)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Critical analysis of liberal, neoclassical, and Marxist perspectives on modern society. Alternative theories of economic growth, historical change, the state, classes, and ideology.
M. Piore, S. Berger

17.125 The Politics of Global Financial Relations (New)
Prereq: —
U (Fall)
3-0-9 HASS
Explore effects of globalization of finance on international relations and domestic politics. Topics include international institutions and global governance; the multi-nationalization of production; effects of international capital markets on domestic politics; global finance and the developing world; and financial crises. Discussion of the interplay between politics and economics and the future of the nation-state.
D. Singer

17.148 Political Economy of Globalization
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Analyzes the impact of trade and financial flows and regional integration on the domestic politics of advanced industrial states. Pressures for harmonization and convergence of domestic institutions and practices and the sources of national resistance to these are examined. Cases are drawn from both the advanced economies and developing countries.
S. Berger

17.158 Political Economy of West Europe
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Examines role of European states in postwar period of rapid economic growth and current crisis. Includes analysis of different state traditions.
17.160 The Political Economy of Institutions
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Explores the impact of political institutions on economic outcomes. In addition to the distinction between authoritarianism and democracy, some of the democratic institutions under consideration include parliamentary and presidential democracy, federal and unitary systems, and electoral rules. Explores economic outcomes including protectionism and free trade, budget deficits and public debt, electoral macroeconomic and budgetary cycles, the size of the aggregate public sector, and rates of economic growth.
J. Rodden

17.162 Federalism and Decentralization
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
The vertical distribution of governmental authority is rapidly changing around the world. Power and revenue are shifting downward (to state and local governments) and upward (to supranational bodies like the European Union). Theory and evidence are used to explore the causes and consequences of these trends. Starts with abstract, normative economic theories of federalism and decentralization and then covers politics and institutions. Approach allows students to address several questions about the vertical organization of the public sector: What is the ideal distribution of governmental authority? How can we explain the actual distribution? What are the welfare consequences of different alternatives? Open to advanced undergraduates with permission of instructor.
J. Rodden

17.176j Economic Development and Policy Analysis I
(Same subject as 11.491j)
Prereq: 11.701
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 11.491j.
A. Amsden

17.181 Sustainable Development: Theory, Research and Policy
(Subject meets with 17.182)
Prereq: —
U (Spring)
3-0-9 HASS
17.182 Sustainable Development: Theory, Research and Policy
(Subject meets with 17.181)
Prereq: —
G (Spring)
3-0-9
Examines alternative conceptions and theoretical underpinnings of the notion of sustainable development. Focuses on the sustainability problems of industrial countries (aging of populations, sustainable consumption, institutional adjustments); and of developing states and economies in transition (managing growth, sustainability of production patterns, pressures of population change). Explores the sociology of knowledge around sustainability, the economic and technological dimensions and institutional imperatives. Implications for political constitution of economic performance. 17.181 fulfills undergraduate public policy requirement in the major and minor. Graduate students are expected to explore the subject in greater depth through reading and individual research.
N. Choucri

17.184j Economic Institutions and Growth Policy Analysis
(Same subject as 11.486j, 14.778j)
Prereq: 11.203
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 11.486j.
A. Amsden, M. Piore

17.188j Labor and Politics
(Same subject as 11.414j)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
Examines issues facing labor in today’s global world through research and reading. Recent developments (globalization, liberalization, privatization) have created a mix of opportunities and risks for labor in most developing countries. On the one hand, these trends have encouraged foreign direct investment and the diffusion of global supply chains, which in turn, have promoted economic development and job growth for some groups of workers in some of these countries. On the other hand, globalization and liberalization have undermined social safety nets, eroded labor and environmental standards, and resulted in greater rates of poverty for other groups of workers in other developing countries. How do we explain these differences? What kinds of policies can be promoted to more evenly distribute the benefits of globalization? Subject seeks to address these two questions.
R. Locke

17.190j Economic Development and Policy Analysis, Part II
(Same subject as 11.492j)
Prereq: 11.491j
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 11.492j.
A. Amsden

17.195 Globalization
(Subject meets with 17.196)
Prereq: Permission of instructor
U (Fall)
3-0-9 HASS
17.196 Globalization
(Subject meets with 17.195)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Analyzes changes in the international economy and their effects in the politics, economy, and society of advanced and emerging countries. Topics include the independence of national governments; wage inequality; unemployment; industrial production outside national borders and its consequences for innovation, efficiency, and jobs; fairness in trade; and mass culture versus local values. 17.195 fulfills undergraduate public policy requirement in the major and minor. Graduate students are expected to explore the subject in greater depth.
S. Berger

17.199j Working in a Global Economy
(Same subject as 21F.098j)
Prereq: Permission of instructor
U (Fall)
3-0-9 HASS, CI-H
For students who have already experienced work and research in today’s global economy. Offers an introduction to core concepts used to under-
stand developments and interdependencies in the new global economy through a combination of conceptual approaches and practical case studies. Combines a broad range of interactive classroom experiences including student presentations and guest speakers from business and academia with first-hand knowledge of how the global economy operates. Explores issues such as global entrepreneurship, the rise of global challengers like India and China, and crosscultural communication in multinational organizations. Enrollment limited.

S. Berger, S. Sferza

AMERICAN POLITICS

17.20 Introduction to the American Political Process
Prereq: —
U (fall, spring)
3-0-9 HASS-D, Category 4, CI-H

Studies American government, emphasizing the institutions of government and the representation of competing interests. Topics include the founding, constitutional interpretation, legislative processes, presidential power, public opinion and voting, group mobilization, political steering of the bureaucracy and the economy, and federalism.

Fall: G. Lenz
Spring: S. Ansolabehere

17.200 Graduate Seminar in American Politics
Prereq: Permission of instructor
G (fall)
3-0-9 H-LEVEL Grad Credit

Analyzes the American political system, with primary emphasis on the national level. Examines American federalism, voting behavior, political parties, and national political institutions. Focuses on core works in contemporary American politics and public policy. Critiques both research methodologies and the explicit and implicit theoretical assumptions of such work.

A. Berinsky

17.243 Media Politics
Prereq: —
U (spring)
3-0-9 HASS

17.244 Media Politics (New)
Prereq: —
G (spring)
3-0-9

Examines why the media cover what they do; how their coverage influences the behavior of politicians and public officials; and how it shapes the attitudes of ordinary people. Focuses mainly on the US, but also includes some comparisons with other countries in both the developed and developing world.

G. Lenz

17.245 The Supreme Court, Civil Liberties, and Civil Rights
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (fall)
3-0-9 HASS

Considers constitutional rights, processes, civil rights and liberties, and criminal procedure. Focus on Supreme Court case law. Enrollment limited.

Staff

17.249J Law and Society
(Same subject as 11.163J, 21A.219J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (spring)
3-0-9 HASS, CI-H

See description under subject 21A.219J.
S. Silbey

17.251 Congress and the American Political System I
(Subject meets with 17.252)
Prereq: 17.20 or permission of instructor
Acad Year 2007–2008: U (fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

17.252 Congress and the American Political System II
(Subject meets with 17.251)
Prereq: Permission of instructor
Acad Year 2007–2008: G (fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Focuses on both the internal processes of the House and Senate and on the place of Congress in the American political system. Attention to committee behavior, leadership patterns, and informal organization. Considers relations between Congress and other branches of government, as well as relations between the two houses of Congress itself. Graduate students are expected to pursue the subject in greater depth through reading and individual research.

C. Stewart

17.253 American Political Economy
(Subject meets with 17.254)
Prereq: 17.20
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (fall)
3-0-9 HASS

17.254 American Political Economy
(Subject meets with 17.253)
Prereq: 17.20
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (fall)
3-0-9 H-LEVEL Grad Credit

Analysis of contemporary and historical issues in US political economy, with special emphasis on public finance and economic regulation. Selected topics in trade and tax policy, agricultural, transport, labor, and environmental regulations, and local public finance treated in some detail. Focuses primarily on the neoclassical/rational-choice approach; strengths and weaknesses of this approach are discussed. Where necessary, devotes time to developing tools used in rigorous microeconomic analysis. Graduate students are expected to pursue the subject in greater depth through reading and individual research.

J. M. Snyder, Jr.

17.261 Congress and the American Political System II
(Subject meets with 17.262)
Prereq: 17.251 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (fall)
3-0-9 HASS

17.262 Congress and the American Political System II
(Subject meets with 17.261)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (fall)
3-0-9 H-LEVEL Grad Credit

Analyzes the development of the US Congress by focusing on the competing theoretical lenses through which legislatures have been studied. Particularly compares sociological and economic models of legislative behavior, applying those models to floor decision-making, committee behavior, political parties, relations with other branches of the federal government, and elections. Graduate students expected to pursue the subject in greater depth through reading and individual research.

C. Stewart
17.263 Electoral Politics
Prereq: 17.20
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Considers the role of elections in American politics. Issues explored include empirical and theoretical models of electoral competition, the effect of elections on public policy, and proposals to improve elections. Special emphasis is given to mass voting behavior, political parties, the media, and campaign finance. Subject focuses on US elections, but provides some contrasts with other countries, especially the UK.

G. Lenz

17.264 Electoral Politics
Prereq: 17.20
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Analyzes elections in light of theories about voters, parties, and candidates. Topics include election laws and reforms, and the formation of governments. Focus is mainly on US elections, though other democracies are also examined. Familiarity with statistics recommended but not required. Open to qualified undergraduates.

G. Lenz

17.265 Public Opinion and American Democracy
Prereq: —
U (Spring)
3-0-9 HASS

Introduces students to public opinion in politics and public policy-making. Surveys theories of political psychology and political behavior. Examines empirical research on public understanding of and attitudes towards important issues, including war, economic and social policies, and moral questions.

A. Berinsky, A. Campbell, S. Ansolabehere

17.266 Public Opinion
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Provides an introduction to the scholarly literature devoted to public opinion. Surveys the major theoretical approaches and empirical research in the field of political behavior. Topics include mass-elite relations, racial politics, political ideology, public opinion and war, public opinion and public policy and media effects. Primarily focuses on American public opinion, though research on comparative public opinion is also covered.

A. J. Berinsky

17.269 Presidential Elections
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines the dynamics of presidential elections: events preceding the primaries, the conduct of the general election itself, and the policy consequences of the electoral process. The class conducts a survey of votes. Topics include the players (candidates, voters, parties, consultants, the Electoral College), campaign resources (money, information, media attention), the major campaign events (primaries, conventions, general elections), and prospects for reform.

S. Ansolabehere

17.270 American Political Development
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Examines the evolution of American national political processes over time: how political culture, governing institutions, and structures of political linkage (parties and organized interests) shape political conflict and public policy. Topics include the evolution of electoral politics and the party system, eras of political reform and state expansion (Populist, Progressive, New Deal, and Great Society), major wars and their effects, and the adaptation of government institutions to crisis and complexity in society and in the economy. Open to undergraduates with permission of instructor.

A. Campbell

17.276 Public Opinion Research Training Lab
Prereq: 17.872 and 17.266; or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Follows 17.266. Offers practical training in public opinion research and provides students with an opportunity to conduct their own survey research. As a group, students design a national sample survey and field the survey. Students analyze the survey results and examine literatures related to the content of the survey. Ideal for second and third year PhD students and advanced undergraduates, though others are welcome.

S. Ansolabehere, A. Berinsky, A. Campbell

17.281 Public Opinion and Foreign Policy (New)
(Subject meets with 17.282)
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Examines the nature of public opinion on foreign policy, the ability of the public to formulate reasoned and interconnected perspectives on the issues of the day, and the public’s influence on foreign policy decisions. Main focus is on the US. The role of the media and international events in shaping public perspectives and public attitudes toward important issues such as internationalism and isolationism, the use of force, and trade are evaluated.

A. Berinsky

PUBLIC POLICY

17.30J Making Public Policy
(Same subject as 11.002J)
Prereq: —
U (Fall)
4-0-8 HASS-D, Category 4, CI-H
See description under subject 11.002J.
J. Layzer, Staff

17.303J Methods of Policy Analysis
(Same subject as 11.003J)
Prereq: 11.002J, 17.30J, 14.01
U (Spring)
3-0-9 HASS
See description under subject 11.003J.
J. M. Schuster, Staff

17.307 American Public Policy for Washington Interns
Prereq: Permission of instructor
U (Fall, Spring)
3-0-9 HASS

Examines US policy-making process, with special attention to making of policy for science and technology. Subject spans Spring and Fall terms. Spring term attends to origins and development of American policymaking institutions and their roles in settling controversial policy questions. Fall term focuses on development of representative policies in the US, such as pollution controls, biotechnical engineering, and telecommunications. Selection and participa-
tion in Washington Summer Internship program required. Fulfills undergraduate public policy requirement in the major and minor.

K. Oye

17.310 Science, Technology, and Public Policy
(Same subject as ESD.103J, STS.482J)
Prereq: Permission of instructor
G (Fall)
3-0-9 HASS, CI-H

Analysis of issues at the intersection of science, technology, public policy, and business. Cases drawn from antitrust and intellectual property rights; health and environmental policy; defense procurement and strategy; strategic trade and industrial policy; and R&D funding. Structured around theories of political economy, modified to take account of integration of uncertain technical information into public and private decision-making. Enrollment limited to 18.

K. Oye

17.311 Politics, Race, and Science
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Comparatively examines the historical and contemporary role of science in constructing knowledge about human differences and similarities in terms of race. Particular attention is paid to the social and political context of scientific inquiry and to its consequences for public policy. Topics include US “Jim Crow” segregation policy, US immigration policy, the US eugenics movement, and the international Human Genome Project.

M. Nobles

17.312 Integrating Doctoral Seminar on Emerging Technologies
(Same subject as ESD.85J, STS.461J)
Prereq: Permission of instructor
G (Fall)
2-0-7 H-LEVEL Grad Credit

See description under subject ESD.85J.

D. Newman, L. McCray

17.314 Labor Market Regulation and Career Mobility
(Same subject as 14.665J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines the way in which workers organize to structure and regulate the labor market and how those efforts interact with (as cause and effect) career mobility. Particular focus on the contrast between union organization and government regulation and on the shift from mobilization around class to mobilization around race, sex and ethnicity. Contrast between unified systems of regulation (France, Spain, Latin America) and fragmented systems (US).

M. Piore

17.315 Health Policy
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Analyzes the health policy problems facing America including adequate access to care, the control of health care costs, and the encouragement of medical advances. Considers market and regulatory alternatives as well as international models including Canadian, Swedish, British, and German arrangements. Emphasis on historical development, interest group behavior, public opinion, and organizational influences in shaping and implementing policy.

A. Campbell

17.317 U.S. Social Policy
Prereq: —
U (Spring)
3-0-9 HASS

Explores historical development and contemporary politics of the American welfare state. Examines interactions among political institutions, elites, the media, and the mass public. Emphasis on reciprocal relationship between policy designs and public opinion/political action. Investigates broad spectrum of government policies that shape well-being, opportunity and political influence, including welfare, social security, health care, education, and tax policy.

A. Campbell

17.32 Environmental Politics and Policy
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
4-0-8 HASS-D, Category 4, CI-H

Examines the collision of politics, economics, values, and science in making and carrying out environmental policy at national, state, and local levels. Case studies of environmental policymaking explore the roles of governmental institutions, business, interest groups, the public, and the media in areas of air and water pollution, hazardous waste disposal, public lands management, and wildlife protection.

Staff

17.391 Human Rights in Theory and Practice (New)
(Same subject as 11.164J)
(Subject meets with 11.497)
Prereq: —
U (Spring)
3-0-9

See description under subject 11.164J.

B. Rajagopal

17.393 Environmental Law, Policy, and Economics: Pollution Prevention and Control (New)
(Same subject as 1.801J, 11.021J)
(Subject meets with 1.811J, 11.630J, ESD.133J)
Prereq: —
U (Fall)
3-0-9 HASS

See description under subject 1.801J.

N. Ashford, C. Caldart

17.398 Energy Policy for a Sustainable Future (New)
(Same subject as 11.369J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 11.369J.

J. D. Raab
International Relations

17.40 American Foreign Policy: Past, Present, and Future
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 4, CI-H

Reasons for America’s past wars and interventions. Consequences of American policies. Evaluation of these consequences for the US and the world. History covered includes World Wars I and II, the Korean and Indochina wars, and the Cuban Missile Crisis and current conflicts such as against al Qaeda.

S. Van Evera

17.405 Seminar on Politics and Conflicts in the Middle East
(Subject meets with 17.406)
Prereq: —
U (Fall)
3-0-9 HASS

17.406 Seminar on Politics and Conflicts in the Middle East
(Subject meets with 17.405)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Focuses on evolution of contemporary politics and economics. Subject divided into five parts: historical context of conflicts; domestic and regional politics; civil and cross-border conflicts; geostrategic challenges; conflict resolution and peace processes. Interactions and spillover effects explored, and alternative models of conflict(s) designed. Graduate students are expected to pursue the subject in greater depth through reading and individual research.

N. Choucri

17.407 Chinese Foreign Policy
(Subject meets with 17.408)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

17.408 Chinese Foreign Policy
(Subject meets with 17.407)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Introduces the international relations of the People’s Republic of China. China’s foreign relations during the Cold War as well as contemporary diplomatic, security and economic issues are examined to identify and explain China’s foreign policy goals and their implementation since 1949. Investigates the sources of conflict and cooperation in China’s behavior, assessing competing explanations for key events and policies. Readings drawn from political science, history, and international relations theory.

M. T. Fravel

17.410 Globalization, Migration, and International Relations
(Subject meets with 17.411)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

17.411 Globalization, Migration, and International Relations
(Subject meets with 17.410)
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Tracing the evolution of international interactions, subject examines the dimensions of globalization in terms of scale and scope. Includes international environmental issues, impacts and expansion of human activities, and the potential implications for global and national policy. Linkages among individuals, nation-states, transnational organizations and firms, international systems, and the global environment. Special focus on models of globalization, challenges of sustainable development, and on evolving types. Institutional responses to globalization and global change. 17.411 fulfills undergraduate public policy requirement in the major and minor. Graduate students are expected to explore the subject in greater depth through reading and individual research.

N. Choucri

17.418 Field Seminar in International Relations Theory
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Provides an overview of the field of international relations. Each week a different approach to explaining international relations is examined. Surveys major concepts and theories in the field to assist in the preparation for further study in the department’s other graduate offerings in international relations.

M. T. Fravel

17.42 Causes and Prevention of War
Prereq: —
U (Spring)
4-0-8 HASS-D, Category 4, CI-H

Examines the causes of war, with a focus on practical measures to prevent and control war. Topics include causes and consequences of miscalculation by nations; military strategy and policy as cause of war; religion and war; US foreign policy as a cause of war and peace; and the likelihood and possible nature of great wars in the future. Historical cases include World War I, World War II, the Korean War, the Seven Years’ War, the Arab-Israel conflict, other recent Middle East wars, and the Peloponnesian War.

S. Van Evera

17.420 Advances in International Relations Theory
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Critical analysis of contending theories of international relations. Focus is on alternative theoretical assumptions, different analytical structures, and a common core of concepts and content. Comparative analysis of realism(s), liberalism(s), institutionalism(s), and new emergent theories. Discussion of connections between theories of international relations and major changes in international relations. Open to undergraduates by permission of instructor.

N. Choucri

17.422 Field Seminar in International Political Economy
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Review of IPE field covering previous and core research focusing on dual national objectives in a global context, namely pursuit of power and pursuit of wealth. Surveys major paradigms
of international political economy, including neoclassical economics, marxist economics, development and ecological economics, lateral pressure, and perspectives and structural views of power relations. Examines interaction of politics and economics on international trade, capital flows, foreign investment, intellectual property rights, international migration, and select issues in foreign economic policy in global context. Examines the evolution of international economic institutions and attendant political implications. Open to undergraduates by permission of instructor.

N. Choucri

17.424 International Political Economy of Advanced Industrial Societies
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Provides an overview of international political economy with specific reference to the advanced industrial societies. Integrates international and comparative perspectives and fuses microeconomic and institutionalist approaches. Compares and contrasts the role of states in regulating intergroup conflicts over domestic markets with the role of regimes in regulating interstate conflicts over international markets. Examines the rise and decline of economic powers, industrial policy and trade relations, financial and monetary politics, and economic integration.

D. Singer

17.428 American Foreign Policy: Theory and Method
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduces and analyzes the international relations of East Asia. Examines the sources of conflict and cooperation during and after the Cold War, assessing competing explanations for key events in East Asia’s international relations. Readings drawn from international relations theory, political science and history.

M. T. Fravel

17.430 Research Seminar in International Relations
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
While this seminar provides an overview of recent literature, its principal purpose is to help graduate students develop skills suited to production of research papers and/or dissertations.

K. Oye

17.432 Causes of War: Theory and Method
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Examines the causes of war. Major theories of war are examined; case study and large-n methods of testing theories of war are discussed; and the case study method is applied to several historical cases. Cases covered include World Wars I and II. Open to undergraduates only by permission of instructor.

S. Van Evera

17.433 International Relations of East Asia (Subject meets with 17.434)
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS
17.434 International Relations of East Asia (Subject meets with 17.433)
Prereq: —
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9
Examines the causes and consequences of American foreign policy since 1898. Readings cover theories of American foreign policy, historiography of American foreign policy, central historical episodes including the two World Wars and the Cold War, case study methodology, and historical investigative methods. Open to undergraduates by permission of instructor.

S. Van Evera

17.440 Global Governance (New)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Research seminar explores the concept of governance at the international level, including the design and function of international institutions and organizations, the role of international law, the rise of transnational actors, and the relationship between domestic politics and international cooperation. Readings also include empirical studies of cooperation in a variety of issue areas, including the environment, human rights, economic affairs, and security.

D. Singer

17.462 Innovation in Military Organizations
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Explores the origins, rate, and impact of innovations in military organizations, doctrine, and weapons. Emphasis on organization theory approaches. Comparisons with nonmilitary and non-US experience included.

B. Posen

17.466 Organization Theory and the Military
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Explores organizational concepts and research methods that explain the performance and development of military organizations in peace
and war. Review of classic studies. Considers approaches to current policy problems based on theoretical insights into military organizations and practices. Stresses development of new theory.

Staff

17.468 Foundations of Security Studies
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Develops a working knowledge of the theories and conceptual frameworks that form the intellectual basis of security studies as an academic discipline. Particular emphasis on balance of power theory, organization theory, civil-military relations, and the relationship between war and politics. The reading list includes Jervis, Schelling, Waltz, Blainey, von Clausewitz, and Huntington. Students write a seminar paper in which theoretical insights are systematically applied to a current security issue.

B. Posen

17.471 American National Security Policy
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
4-0-8 HASS, CI-H

Examines the problems and issues confronting American national security policy since 1945, with special attention to the politics of policymaking. The nature of the international system (post–World War II), the theoretical requirements for deterrence and defense, and alternative strategies for implementing American national security policy are discussed. The roles of the President, National Security Council, Department of Defense and armed services, the Congress, and public opinion in formulating national security policy are examined. Subject fulfills undergraduate public policy requirement in the major and minor. Enrollment limited.

Staff

17.475] Nuclear Forces and Missile Defenses
(Same subject as STS.072)
(Subject meets with 17.476], STS.435)
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

17.476] Nuclear Forces and Missile Defenses
(Same subject as STS.435)
(Subject meets with 17.475], STS.072)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Introduces the assessment of strategic nuclear forces. Emphasizes the development of force requirements. Methods for analyzing alternative force postures in terms of missions, effectiveness, and cost. The history of the US-Soviet strategic competition provides the backdrop against which the evolution of nuclear strategy and forces is considered. Students taking the graduate version are expected to complete additional assignments.

T. Postol

17.477] Technology and Policy of Weapons Systems
(Same subject as STS.076)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

See description under subject STS.076.

T. Postol

17.478 Great Power Military Intervention
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Examines systematically, and comparatively, great and middle power military interventions, and candidate military interventions, into civil wars since 1991. These civil wars did not easily fit into the traditional category of vital interest. These interventions may therefore tell us something about broad trends in international politics including the nature of unipolarity, the erosion of sovereignty, the security implications of globalization, and the nature of modern western military power.

B. Posen

17.482 US Military Power
(Subject meets with 17.483)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

17.483 US Military Power
(Subject meets with 17.482)
Prereq: Freshmen need permission of instructor
U (Spring)
3-0-9 HASS

Examines the evolving roles and missions of US General Purpose Forces within the context of modern technological capabilities and Grand Strategy, which is a conceptual system of interconnected political and military means and ends. Topics include US Grand Strategies; the organization of the US military; the defense budget; and the capabilities and limitations of naval, air, and ground forces. Also examines the utility of these forces for power projection and the problems of escalation. Analyzes military history and simple models of warfare to explore how variations in technology and battlefield conditions can drastically alter effectiveness of conventional forces. 17.483 fulfills undergraduate public policy requirement in the major and minor. Graduate students are expected to explore the subject in greater depth.

B. Posen

17.484 Comparative Grand Strategy and Military Doctrine
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

A comparative study of the grand strategies and military doctrines of the great powers in Europe (Britain, France, Germany, and Russia) from the late 19th to the mid-20th century. Examines strategic developments in the years preceding and during World Wars I and II. What factors have exerted the greatest influence on national strategies? How may the quality of a grand strategy be judged? Exploration of comparative case study methodology also plays a central role. What consequences seem to follow from grand strategies of different types? Open to undergraduates with permission of instructor.

B. Posen

17.486 Japan and East Asian Security
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Explores Japan’s role in world orders, past, present, and future. Focuses on Japanese conceptions of security; rearmament debates;
PART 3

the relationship of domestic politics to foreign policy; the impact of Japanese technological and economic transformation at home and abroad; alternative trade and security regimes; Japan’s response to 9/11; and relations with Asian neighbors, Russia, and the alliance with the United States.

R. J. Samuels

COMPARATIVE POLITICS

17.504 Ethnic Politics I
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
4-0-8 H-LEVEL Grad Credit

17.506 Ethnic Politics II
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8 H-LEVEL Grad Credit

Introduces students to the classic works on ethnic politics, familiarizes them with new research and methodological innovations in the study of ethnic politics, and helps them design and execute original research projects related to ethnic politics. Readings drawn from across disciplines, including political science, anthropology, sociology, and economics. Students read across the four subfields within political science. Graduate students specializing in any subfield are encouraged to take this subject, regardless of their previous empirical or theoretical background. Designed as a year-long research workshop, but may also be taken in either term.

M. T. Fravel

17.507 Democratization and Democratic Breakdown
(Subject meets with 17.508)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Examines the dynamics of regime change, both transitions to democracy and the collapse of democratic systems. Readings focus on several case studies, from the collapse of democracy in Weimar Germany to political transition in Mexico today, that help to illustrate broader theoretical issues. Graduate students are expected to explore the subject in greater depth through reading and individual research.

C. Lawson

17.509 Social Movements in Comparative Perspective
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Explores why people join grassroots political organizations and social movements. Asks what accounts for the ultimate success or failure of these organizations and examines how social movements have altered political parties, political institutions, and social relations. Critically considers a range of theoretical treatments and several movements, including the US civil rights, poor peoples’, pro-life/pro-choice and gay/lesbian movements.

M. Nobles

17.51 Politics, Economics, and Democracy
Prereq: —
U (Spring)
3-0-9 HASS

Surveys the major types of democratic institutions, including parliamentary and presidential regimes, federal and unitary systems, coalition governments, and several other important distinctions. Explores the implications of these institutional arrangements for stability, good government, and economic development.

J. Rodden

17.516 Transitional Justice
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Emerging democracies are now confronted with what has been termed “the torturer problem.” The questions are old ones: What is to be done about the perpetrator(s) and what is to be done for the abused? Seminar broadly examines the theoretical and empirical approaches to understanding the issues commonly associated with “transitional justice,” including its motivations, agents, institutions, and decisions. Cases are drawn from various countries and historical periods, including post-World War II Europe, 19th century America, and 20th century Africa and Latin America.

M. Nobles

17.517 Participation in Public Life
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines how and why people participate in public life and political affairs. Drawing on examples from around the world, students analyze the effects of social networks, community norms, and associational activities on the functioning of democracy, regime stability, state capacity, and international politics.

L. Tsai

17.522 Politics and Religion
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Explores the role of religious groups, institutions, and ideas in politics using social science theories. Open to advanced undergraduate students with permission of instructor.

L. Tsai

17.523 Ethnicity and Race in World Politics
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Ethnic and racial conflict appear to be the hallmark of the post-Cold War world. What accounts for the rise of ethnic/racial and nationalist sentiments and movements? What is the basis of ethnic and racial identity? What are the political claims and goals of such movements and is conflict inevitable? Introduces students to dominant theoretical approaches to race, ethnic-
Political Science

17.524 Nationalism
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
Explores the related phenomena termed nationalism: national consciousness and identity, nation-states, and nationalist ideologies and nationalist movements. Analyzes nationalism’s emergence and endurance as a factor in modern politics and society. Topics include nationalism and state-building, nationalism and economic modernization, nationalism and democratization, and nationalism and religious conflict.
M. Nobles

17.526 Dissertation Workshop in Comparative Politics and Comparative Political Economy
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Designed for PhD students embarking on dissertation research in the fields of comparative politics and comparative political economy. Aimed particularly at those students who have already passed their general exams, although others admitted with permission of instructor. Focuses on issues associated with designing and undertaking a substantive piece of research. Begins by examining a number of examples of successful research with a view to examining how they were designed, what research problems they confronted, and how they were surmounted. The second part reviews alternative methodologies for carrying out the research. In the final part, participants’ research proposals are discussed with an eye to both their substantive and methodological dimensions.
S. Berger, R. Locke

17.528 Civil Society, Social Capital, and the State in Comparative Perspective
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
Examines the growing body of research suggesting that social networks, community norms, and social organizations can have important effects on social welfare, political stability, economic development, and governmental performance. Cases drawn from various countries and focus on the effects of networks, norms, and organizations on outcomes ranging from local public goods provision and the performance of democracies to ethnic conflict and funding for terrorism.
L. Tsai

17.530 The State
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Explores why states exist and how they evolve. Analyzes state-building, state capacity, state failure, and the role of the state in political and economic outcomes.
L. Tsai

17.534 Domestic Politics of Western Europe
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Compares politics and society in France, Great Britain, Germany, and Italy. Analyzes cases of the integration of feudal remnants and the problem of controlling the economy. Open to qualified undergraduates with permission from instructor.
S. Berger

17.537 Politics and Policy in Contemporary Japan
(Subject meets with 17.538)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
17.538 Politics and Policy in Contemporary Japan
(Subject meets with 17.537)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Analyzes contemporary Japanese politics, focusing primarily upon the post-World War II period. Includes examination of the dominant approaches to Japanese politics and society, the structure of the party system, the role of political opposition, the policy process, foreign affairs, and interest groups. Attention to defense, foreign, industrial, social, energy, and technology policy processes. Graduate students are expected to pursue the subject in greater depth through reading and class presentations. Assignments differ.
R. J. Samuels

17.541 Japanese Politics and Society
(Subject meets with 17.543)
Prereq: —
U (Fall)
2-0-4 [P/D/F]
17.543 Japanese Politics and Society
(Subject meets with 17.541)
Prereq: —
U (Fall)
2-0-7 HASS
Lectures, seminar discussion, small-team case studies, and web page construction exercises shed light on contemporary Japan. Focus on four substantive topics: politics and history, economy and technology, education and the workplace, and community/civil society. Subject 17.543 requires additional readings, two short papers, and a final exam.
R. Samuels

17.544 Comparative Politics and China
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Seminar has two main goals: explores the main theoretical and methodological approaches to the study of contemporary Chinese politics; and relates those approaches to broader trends in the field of comparative politics. What has the study of China contributed to the field of comparative politics, and vice versa? What are the most effective ways to integrate area studies, broader comparative approaches, and theory? Seminar presumes a basic understanding of the history and politics of contemporary China.
E. Steinfeld

17.545 Political Change in South Asia
(Subject meets with 17.546)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
17.546 Political Change in South Asia
(Subject meets with 17.545)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Examines the major political changes occurring in South Asia: economic liberalization; state structures; changing role of caste, linguistic, religious, tribal, and class forces; the changing role of political parties and the military. Graduate students are expected to pursue the subject in greater depth through reading and individual research.
Staff
17.547 The Rise of China
(Subject meets with 17.548)
Prereq: —
U (Fall)
3-0-9 HASS

17.548 The Rise of China
(Subject meets with 17.547)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Examines the causes and consequences of China’s emergence as a global economic and political force. Employing perspectives from comparative politics and international relations, subject examines the connections between China’s domestic transformation and its foreign policy. Topics include the historical process of China’s rise, contemporary challenges facing the Chinese system, and the impact of China’s rise on issues of regional and global concern, including military security, economic competitiveness, environmental sustainability, and political stability.

E. Steinfeld

17.551 Political Economy of Chinese Reform
(Subject meets with 17.552)
Prereq: —
U (Spring)
3-0-9 HASS

17.552 Political Economy of Chinese Reform
(Subject meets with 17.551)
Prereq: —
G (Spring)
3-0-9 H-LEVEL Grad Credit

Focuses on China’s transition from plan to market. What has the trajectory of institutional change in China been, and how has growth been achieved? Is that growth sustainable? Subject examines specific aspects of reform (enterprise, fiscal, financial, social welfare), and the systemic consequences of interaction between various reform measures. Additional topics include the interaction between political and economic change, the transformation of state-society relations, and the generalizability of China’s reform experience. Graduate students are expected to explore the subject in greater depth.

E. Steinfeld

17.553 Introduction to Latin American Studies
(Same subject as 21A.430J, 21F.084J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4, CI-H

Interdisciplinary introduction to contemporary Latin America, drawing on films, literature, popular press accounts, and scholarly research. Topics include economic development, ethnic and racial identity, religion, revolution, democracy, transitional justice, and the rule of law. Examples draw on a range of countries in the region, especially Mexico, Chile, and Brazil. Includes a heavy oral participation component, with regular breakout groups, formal class presentations on pressing social issues (such as criminal justice and land tenure), and a structured class debate.

C. Lawson

17.554 Political Economy of Latin America
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Covers the main topics in Latin American politics over the last four decades: modernization, bureaucratic authoritarianism, civil military relations, the politics of economic reform, political transition, party systems, voting behavior, interest groups, new social movements, the mass media, political culture, and US–Latin American relations. Open to qualified undergraduates with permission of instructor.

C. Lawson

17.556 Political Economy of Development
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Examines theoretical and empirical approaches to understanding the process of late development. Topics include the role of the state in alleviating or exacerbating poverty, the politics of industrial policy and planning, and the relationship between institutional change and growth. How over the past century have some of the world’s poorest nations achieved wealth? How have others remained mired in poverty? What are the social consequences for alternative strategies of development?

E. Steinfeld

17.558 Political Economy and Technological Change in the Middle East
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Provides a focus on, and context for, technology change, with specific reference to contemporary conflicts and competing ideologies, Islam and politics, post-colonial experiences, and patterns of social pressures. Examines role of technological and scientific institutions, and potentials for technology leapfrogging. Changing environment of international business is explored, as are patterns of investments in the region. Provides students with interdisciplinary approach to development in the Middle East. Open to undergraduates with permission of instructor.

N. Choucri

17.559 Comparative Security and Sustainability
(Subject meets with 17.560)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

17.560 Comparative Security and Sustainability
(Subject meets with 17.559)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Focuses on comparative approaches to security and sustainability in national and international contexts, with special emphasis on constraints, options, strategies, and policy choice. Comparisons are undertaken in terms of levels and locations (countries and regions, localities); systems (social, economic, political, and technological); methods and models (analytical, empirical, historical); time frame (past, present, and future). Levels and locations include developing and industrial contexts encompassed in a global perspective. Emphasis on specific countries and coverage shaped by students’ interest and participation. Graduate students are expected to pursue the subject in greater depth through reading and individual research.

N. Choucri

17.571 Soviet and Post-Soviet Politics and Society, 1917–Present
(Subject meets with 21H.467J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4

See description under subject 21H.467J.

E. Wood
Surveys the social science literature on civil war. Studies the origins of civil war, discusses variables affecting duration, and examines termination of conflict. Highly interdisciplinary and covers a wide variety of cases. Open to advanced undergraduates with permission of instructor. R. Petersen

17.588 Field Seminar in Comparative Politics
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
An introduction to the field of comparative politics for first-year graduate students in political science. Readings include both classic and modern materials. Discuss research design and research methods, in addition to topics such as political culture, social cleavages, regime change, democratic institutions, parties and interest groups, comparative political behavior, civil military relations, and ethnic politics. Emphasis on each issue depends in part on the interests of the students.
C. Lawson

MODELS AND METHODS

17.869 Political Science Scope and Methods
Prereq: —
U (fall)
3-0-9 HASS
Introduces principles of empirical and theoretical analysis in political science through research projects currently conducted in the department. Different department faculty lead modules that introduce students to major research questions and different ways of examining those questions. Emphasizes how this research in progress relates to larger themes, and how researchers confront obstacles to inference in political science. Includes substantial instruction and practice in writing (with revision) and oral presentations. Intended primarily for majors and minors.
A. Berinsky

17.871 Political Science Laboratory
Prereq: 17.869 or permission of instructor
U (Spring)
3-6-6 Institute LAB
Introduces students to the conduct of political research using quantitative methodologies. The methods are examined in the context of specific political research activities like public opinion surveys, voting behavior, Congressional behavior, comparisons of political processes in different countries, and the evaluation of public policies. Students participate in joint class projects and conduct individual projects. Does not count toward HASS Requirement.
G. Lenz

17.872 Quantitative Research Methods I: Introduction
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to elementary statistics and its application in social sciences. Teaches students how to read and interpret the quantitative literature in various subfields of political science and public policy. Students develop elementary statistical computation skills and learn to use a statistical computing package.
S. Ansolabehere

17.874 Quantitative Research Methods II: Multivariate
Prereq: 17.871 or 17.872; at least one subject in statistics
G (Spring)
3-0-9 H-LEVEL Grad Credit
Focus on multivariate data analysis procedures, emphasizing regression. Considers model specification, autocorrelation, instrumental variables, and causal modelling. Open to qualified undergraduates.
J. Snyder

17.878 Qualitative Research: Design and Methods
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Seminar explores the development and application of qualitative research designs and methods in political analysis. Considers a broad array of approaches, from exploratory narratives to focused-comparison case studies, for investigating plausible alternative case studies. The focus is on analysis, not data collection.
R. Locke

17.881 Game Theory and Political Theory (Subject meets with 17.882)
Prereq: —
U (Fall)
3-0-9 HASS
Introduces students to the rudiments of game theory within political science. Provides all students with the ability to solve simple games. Graduate students evaluate “applied theory” articles in the major journals. Readings draw from basic texts on game theoretic modeling and applied articles in American Politics, International Relations, and Comparative Politics. Graduate students are expected to explore the subject in greater depth.
J. Snyder

17.884J Collective Choice I
(Same subject as 14.296J)
Prereq: —
G (Fall)
3-0-9
An applied theory subject analyzing political institutions from a rational choice perspective. The chief focus is the burgeoning literature on elections, legislatures, bureaucracies, and courts. Pays some attention to institutions from a comparative perspective. Advanced undergraduates may take subject with permission of instructor.
J. M. Snyder, Jr.

17.886J Collective Choice II
(Same subject as 14.295J)
Prereq: 17.884J or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Focuses on the relationship between the behavioral models developed by formal theorists and the statistical models used in empirical estimation. The main questions are: How do researchers make the link between theory and the data? How do they generate and estimate statistical models that allow careful testing of the behavioral models? What constitutes a good test of a model? Questions studied through
reading and discussion of articles that combine both empirical and theoretical analysis.

J. M. Snyder, Jr.

17.888 Field Research Methods
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-2-8 H-LEVEL Grad Credit

Introduces a variety of approaches and methods for conducting field research, including elite interviewing, participant observation, case studies, electoral analysis, cross-cultural survey research, and documentary research. Attention to conceptual, practical, and ethical issues of conducting research abroad, e.g., the role of language in social research, the limits and uses of official sources, and ethical responsibilities of social scientists. Students analyze “exemplary” publications based on field research and prepare and discuss their own research proposals.

Staff

17.891 Computational Politics
(Subject meets with 17.892)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9

17.892 Computational Politics
(Subject meets with 17.891)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9

Explores computational models of political behavior; an emerging area in political science. Connections between cognitive processes, intents, goals, and actual behaviors. Specific applications in the domains of international relations (conflict and violence) and comparative politics (internal stability and security).

N. Choucri

17.893 Community Service: Experience and Reflection
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Seminar involves students in the community that exists beyond the labs and classrooms of the MIT campus. Through a combination of community service and academic study, students learn about political, economic, and social issues that confront residents in Boston and Cambridge. Students volunteer in a community service agency or private organization devoted to community needs and development. Students also responsible for directed readings, short writing assignments, and six seminar sessions. Subject can only be repeated for credit if area of community service is different.

C. Stewart

17.899–17.911 Reading Seminar in Social Science
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Reading and discussion of special topics in the fields of social science. Enrollment may be limited. Priority given to pre-registrants.

Staff

17.900 Foundations of Political Science
Prereq: Permission of Instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Fundamental ideas, theories, and methods in modern political science through the study of a small number of high-quality books and articles that have been influential in the field. The first term focuses on issues of political theory (including both normative philosophy and individual motivations) and international relations. The second term focuses on American and comparative politics. Restricted to first-year political science PhD students.

Fall: M. Nobles
Spring: C. Lawson

17.901 Political Science Internship and Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

17.902 Political Science Internship and Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Independent research enabling students to do work in an agency, state, or local government, or other public organization. The academic component involves close contact between the student and a faculty advisor and written work.

C. Stewart

17.903 Community Service: Experience and Reflection
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

17.905–17.911 Reading Seminar in Social Science
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

17.912, 17.914, 17.916–919 Special Topics in Political Science
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Reading and discussion of special topics in the field of social science. 17.909 is taught P/D/F.

C. Stewart

17.920 Special Topics in Political Science
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Reading and discussion of special topics in the field of social science.

C. Stewart

GENERAL SUBJECTS

17.907 Reading Seminar in Social Science
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

Reading and discussion of special topics in the fields of social science. Enrollment may be limited. Priority given to pre-registrants.

Staff

17.910, 17.912, 17.914, 17.916–919 Special Topics in Political Science
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Reading and discussion of special topics in the field of social science. 17.909 is taught P/D/F.

C. Stewart

17.912, 17.914, 17.916–919 Special Topics in Political Science
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Reading and discussion of special topics in the field of social science.

C. Stewart
17.921l Independent International Research Project
(Same subject as 21F.099l)
Prereq: Permission of instructor
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

Independent research for students who would like to pursue a research project during their stay abroad. Initiated with faculty advisor during the term prior to leaving, students are expected to conduct research during stay abroad and complete project after return to campus. The academic component involves close contact between the student and a faculty advisor, written work, and oral presentation.

S. Berger, B. Widdig

17.950–17.953 Special Graduate Topic in Political Science
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Open to qualified graduate students who would like to pursue special subjects or projects. Please consult graduate administration prior to registration.

Staff

17.954–17.960 Reading Seminar in Social Science
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Reading and discussion of special topics in the fields of social science. Open to advanced graduate students by arrangement with individual staff members. 17.954 and 17.959 are taught P/D/F.

C. Stewart

17.962 Major Research Paper
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research and writing of major research paper as part of pre-dissertation requirements; to be arranged by the student with supervising committee. Restricted to doctoral students.

C. Stewart

17.THG Graduate Political Science Thesis
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research and writing of thesis; to be arranged by the student with supervising committee.

C. Stewart

17.ThT Thesis Research Design Seminar
Prereq: 17.869, 17.871, or permission of instructor
U (Fall)
3.0-9

Students writing a thesis in Political Science develop their research topics, review relevant research and scholarship, frame their research questions and arguments, choose an appropriate methodology for analysis, and draft the introductory and methodology sections of their theses. Includes substantial instruction and practice in writing with revision and oral presentations.

R. Petersen

17.ThU Undergraduate Political Science Thesis
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit

Program of research leading to the writing of an SB thesis. To be arranged by the student under approved supervision.

C. Stewart
GENERAL MATHEMATICS

18.01 Calculus
Prereq: —
U (Fall, Spring)
5-0-7 CALC I
Credit cannot also be received for 18.014, 18.01A

Assumes knowledge of elementary calculus. Topics: axioms for the real numbers; the Riemann integral; limits, theorems on continuous functions; derivatives of functions of one variable; the fundamental theorems of calculus; Taylor’s theorem; infinite series, power series, rigorous treatment of the elementary functions.

18.02 Calculus
Prereq: 18.01
U (Fall, Spring)
5-0-7 CALC II
Credit cannot also be received for 18.022, 18.023, 18.024, 18.02A

18.023 Calculus with Applications
Prereq: 18.01
U (Fall)
5-0-7 CALC II
Credit cannot also be received for 18.02, 18.022, 18.02A

18.024 Calculus with Theory
Prereq: 18.014
U (Spring)
5-0-7 CALC II
Credit cannot also be received for 18.02, 18.02A

18.03 Differential Equations
Prereq: 18.02, 18.02A, 18.022, 18.023, or 18.024
U (Fall, Spring, Summer)
5-0-7 REST
Credit cannot also be received for 18.034

18.01A Calculus with Theory
Prereq: —
U (Fall)
5-0-7 CALC I
Credit cannot also be received for 18.01, 18.01A

Continues 18.01. Parallel to 18.02, but at a deeper level, emphasizing careful reasoning and understanding of proofs. Considerable emphasis on linear algebra and vector integral calculus.

18.022 Calculus
Prereq: 18.01
U (Fall)
5-0-7 CALC II
Credit cannot also be received for 18.02, 18.02A, 18.024, 18.02A

18.023 Calculus with Theory
Prereq: 18.01
U (Fall)
5-0-7 CALC II
Credit cannot also be received for 18.02, 18.02A

18.024 Calculus with Theory
Prereq: 18.014
U (Spring)
5-0-7 CALC II
Credit cannot also be received for 18.02, 18.023, 18.02A

18.03 Differential Equations
Prereq: 18.02, 18.02A, 18.022, 18.023, or 18.024
U (Fall, Spring, Summer)
5-0-7 REST
Credit cannot also be received for 18.034

Study of ODE’s, including modeling physical systems. Solution of first-order ODE’s by analytical, graphical and numerical methods. Linear ODE’s, primarily second order with constant coefficients. Complex numbers and exponentials. Inhomogeneous equations: polynomial, sinusoidal and exponential inputs. Oscillations, damping, resonance. Fourier series inputs; resonant terms. Laplace transform methods; convolution and delta function. Matrix methods for first order linear systems: eigenvalues and eigenvectors, matrix exponentials, variation of
parameters. Nonlinear autonomous systems: critical point analysis, phase plane diagrams, applications to modeling.
Fall: A. Toomre
Spring: H. R. Miller

18.034 Differential Equations
Prereq: 18.02, 18.02A, 18.022, 18.023, or 18.024
U (Spring)
5-0-7 REST
Credit also be received for 18.03
Covers much of the same material as 18.03 with more emphasis on theory. The point of view is rigorous and results are proven. Local existence and uniqueness of solutions. First order equations, separation, initial value problems. Systems, linear equations, independence of solutions, undetermined coefficients. Singular points and periodic orbits of planar systems.
Y. Hur

18.04 Complex Variables with Applications
Prereq: 18.02; 18.03 or 18.034
U (Spring)
4-0-8
Credit also be received for 18.075
Complex algebra and functions; analyticity; contour integration, Cauchy’s theorem; singularities, Taylor and Laurent series; residues, evaluation of integrals; multivalued functions, potential theory in two dimensions; Fourier analysis and Laplace transforms.
A. Toomre

18.05 Introduction to Probability and Statistics
Prereq: 18.01
U (Spring)
3-0-9 REST
Credit also be received for 6.041
D. Gutfreund

18.06 Linear Algebra
Prereq: 18.02
U (Fall, Spring, Summer)
4-0-8 REST
Credit also be received for 18.700
Basic subject on matrix theory and linear algebra, emphasizing topics useful in other disciplines, including systems of equations, vector spaces, determinants, eigenvalues, singular value decomposition, and positive definite matrices. Applications to least-squares approximations, stability of differential equations, networks, Fourier transforms, and Markov processes. Uses MATLAB. Compared with 18.700, more emphasis on matrix algorithms and many applications.
Fall: S. G. Johnson
Spring: G. Strang

18.062 Mathematics for Computer Science
(Same subject as 6.042)
Prereq: 18.01
U (Fall, Spring)
5-0-7 REST
See description under subject 6.042).
A. R. Meyer, T. Leighton

18.075 Advanced Calculus for Engineers
Prereq: 18.02, 18.03
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit (H except for Course 2, 6, 8, 12, 13, 16, 18, and 22 students)
Credit also be received for 18.04
Functions of a complex variable; calculus of residues. Ordinary differential equations; Bessel and Legendre functions; Sturm-Liouville theory; partial differential equations.
Fall: J. W. Bush
Spring: D. J. Benney

18.085 Computational Science and Engineering I
Prereq: 18.02; 18.03 or 18.034
G (Fall, Spring, Summer)
3-0-9 H-LEVEL Grad Credit
Review of linear algebra, applications to networks, structures, and estimation, finite difference and finite element solution of differential equations, Laplace’s equation and potential flow, boundary-value problems, Fourier series, discrete Fourier transform, convolution. Frequent use of MATLAB in a wide range of scientific and engineering applications.
Fall: G. Strang
Spring: A. R. Kasimov

18.086 Computational Science and Engineering II
Prereq: 18.02; 18.03 or 18.034
G (Spring)
3-0-9 H-LEVEL Grad Credit
B. Seibold

18.089 Review of Mathematics
Prereq: —
G (Summer)
Units arranged
One-week review of one-variable calculus (18.01), followed by concentrated study covering multivariable calculus (18.02), two hours per day for five weeks. Primarily for graduate students in Course 2N. Degree credit allowed only in special circumstances.
Information: A. P. Mattuck

18.094 Teaching College-Level Science
(Same subject as 5.95, 7.59, 8.395)
Prereq: —
G (Spring)
2-0-2 [P/D/F]
See description under subject 5.95).
L. Breslow

18.095 Mathematics Lecture Series
Prereq: 18.01
U (IAP)
2-0-4 [P/D/F]
Can be repeated for credit
Ten lectures by mathematics faculty members on interesting topics from both classical and modern mathematics. All lectures accessible to students with calculus background and an interest in mathematics. At each lecture, reading and exercises are assigned. Students prepare these for discussion in a weekly problem session.
Information: H.R. Miller

18.096 Principles of Mathematics Presentation
Prereq: —
U (Spring)
2-1-6
Instruction in preparing and presenting professional papers in mathematics, including a tutorial providing individual guidance in editing and formatting a paper to make it suitable for publication in MIT’s Undergraduate Journal of Mathematics. Students lecture on their papers and on topics of their choice, and write reviews of each other’s lectures. Students must come with a draft containing an adequate amount of technical mathematics, such as a term paper or a research report. Enrollment limited, with preference given to senior Mathematics majors.
S. Kleiman
18.098 Independent Activities
Prereq: —
U (IAP)
Units arranged [P/D/F]
Can be repeated for credit
Studies or special individual reading arranged in consultation with individual faculty members and subject to departmental approval.
Information: H. R. Miller

18.099 Independent Activities
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Studies (during IAP) or special individual reading (during regular terms). Arranged in consultation with individual faculty members and subject to departmental approval.
Information: H. R. Miller

ANALYSIS

18.100 Analysis I
Prereq: 18.02; 18.03 or 18.034
U (Fall, Spring)
3-0-9 H (except for Course 18 students)
Three options offered, each covering fundamentals of mathematical analysis: convergence of sequences and series, continuity, differentiability, Riemann integral, sequences and series of functions, uniformity, interchange of limit operations. Each option shows the utility of abstract concepts and teaches understanding and construction of proofs. Option A chooses less abstract definitions and proofs, and gives applications where possible. Option B is more demanding and is for students with more mathematical maturity; it places more emphasis on point-set topology and n-space, whereas Option C is concerned primarily with the real line. Option C is a 15-unit (4-0-11) variant of Option B, with further instruction and practice in written and oral communication.
18.100A: Information: A. P. Mattuck
18.100B: Information: R. B. Melrose
18.100C: Information: H. R. Miller

18.101 Analysis II
Prereq: 18.100; 18.700 or 18.701
U (Fall)
3-0-9 H (except for Course 18 students)
Introduction to the theory of manifolds: vector fields and densities on manifolds, integral calculus in the manifold setting and the manifold version of the divergence theorem. 18.901 helpful but not required.
B. D. Parker

18.102 Introduction to Functional Analysis
Prereq: 18.100; 18.06, 18.700, or 18.701
U (Fall)
3-0-9 H-LEVEL Grad Credit H (except for Course 18 students)
R. B. Melrose

18.103 Fourier Analysis-Theory and Applications
Prereq: 18.100
U (Spring)
3-0-9 H (except for Course 18 students)
Continues 18.100. Roughly half the subject devoted to the theory of the Lebesgue integral with applications to probability, and half to Fourier series and Fourier integrals.
D. S. Jerison

18.104 Seminar in Analysis
Prereq: 18.100
U (Spring)
3-0-9
Seminar for Mathematics majors. Students present and discuss subject matter taken from current journals or books. Topics vary from year to year. Topic for spring 2008: Problem solving in analysis. Instruction and practice in written and oral communication provided. Enrollment limited.
T. S. Mrowka

18.112 Functions of a Complex Variable
Prereq: 18.100B, 18.100C or 18.901
U (Fall)
3-0-9 H (except for Course 18 students)
S. Helgason

18.116 Riemann Surfaces
Prereq: 18.112
G (Spring)
3-0-9 H-LEVEL Grad Credit
Riemann surfaces, uniformization, Riemann-Roch Theorem. Theory of elliptic functions and modular forms. Some applications, such as to number theory.
M. E. Gualtieri

18.117 Topics in Several Complex Variables
Prereq: 18.112, 18.965
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Harmonic theory on complex manifolds, Hodge decomposition theorem, Hard Lefschetz theorem. Vanishing theorems. Theory of Stein manifolds. As time permits students also study holomorphic vector bundles on Kähler manifolds.
T. S. Mrowka

18.125 Real and Functional Analysis
Prereq: 18.100
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introductions to set theory and general topology as needed in analysis. Measure and integration on general spaces. Introduction to functional analysis, Banach and Hilbert spaces.
Information: R. M. Dudley

18.135 Geometric Analysis
Prereq: 18.125
G (Spring)
3-0-9 H-LEVEL Grad Credit
Harmonic analysis in Euclidean space. The Radon transform, its operational properties and its applications to differential equations, particularly the wave equation. The d-plane transform. Non-Euclidean Fourier analysis and potential theory. Eigenfunctions and hyperfunctions.
S. Helgason

18.152 Introduction to Partial Differential Equations
Prereq: 18.100
U (Fall)
3-0-9 H (except for Course 18 students)
Initial and boundary value problems for the wave and heat equation, including an introduc-

R. E. Lenzmann

18.155 Differential Analysis
Prereq: 18.103
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.156 Differential Analysis
Prereq: 18.155
G (Spring)
3-0-9 H-LEVEL Grad Credit


Fall: T. Kemp
Spring: R. B. Melrose

18.157 Introduction to Microlocal Analysis
Prereq: 18.155
G (Fall)
3-0-9 H-LEVEL Grad Credit

The semi-classical theory of partial differential equations. Discussion of Pseudodifferential operators, Fourier integral operators, asymptotic solutions of partial differential equations, and the spectral theory of Schroedinger operators from the semi-classical perspective. Heavy emphasis placed on the symplectic geometric underpinnings of this subject.

R.B. Melrose

18.158 Topics in Differential Equations
Prereq: 18.157
G (Spring)
3-0-9 H-LEVEL Grad Credit

Can be repeated for credit

Content varies from year to year. Topic for spring 2008: Spectral and conformal geometry.

P. Albin

18.175 Theory of Probability
Prereq: 18.125
G (Spring)
3-0-9 H-LEVEL Grad Credit

Laws of large numbers and central limit theorems for sums of independent random variables, conditioning and martingales, Brownian motion, and elements of diffusion theory.

D. W. Stroock

18.177 Stochastic Processes
Prereq: 18.175
G (Spring)
3-0-9 H-LEVEL Grad Credit

Can be repeated for credit

Free probability theory, from a probabilistic perspective. Topics include: classical (ito) and free stochastic calculus; Levy processes, and free Levy processes; and random matrices and large deviations. Knowledge of 18.156 helpful but not required.

T. Kemp

18.199 Graduate Analysis Seminar
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-21 H-LEVEL Grad Credit

Can be repeated for credit

Studies original papers in differential analysis and differential equations. Intended for first- and second-year graduate students. Permission must be secured in advance.

R. B. Melrose

18.238 Geometry and Quantum Field Theory
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Can be repeated for credit

A rigorous introduction designed for mathematicians into perturbative quantum field theory, using the language of functional integrals. Basics of classical field theory. Free quantum theories. Feynman diagrams. Renormalization theory. Local operators. Operator product expansion. Renormalization group equation. The goal is to discuss, using mathematical language, a number of basic notions and results of QFT that are necessary to understand talks and papers in QFT and string theory.

K. Kremnizer

18.276 Mathematical Methods in Physics
Prereq: 18.745 or some familiarity with Lie theory
G (Spring)
3-0-9 H-LEVEL Grad Credit

Can be repeated for credit

Content varies from year to year. Recent developments in quantum field theory require mathematical techniques not usually covered in standard graduate subjects. Topic for Spring 2008: symplectic methods in classical and semi-classical mechanics.

V. W. Guillemin

APPLIED MATHEMATICS

18.303 Linear Partial Differential Equations
Prereq: 18.02; 18.03 or 18.034
U (Fall)
3-0-9

The classical partial differential equations of applied mathematics: diffusion, Laplace/Poisson, and wave equations. Methods of solution, such as separation of variables, Fourier series and transforms, eigenvalue problems. Green's function methods are emphasized. 18.04 or 18.112 are useful, as well as previous acquaintance with the equations as they arise in scientific applications.

A. R. Kasimov

18.304 Undergraduate Seminar in Discrete Mathematics
Prereq: 18.310 or 18.310C, 18.700 or permission of instructor
U (Fall, Spring)
3-0-9

Credit cannot also be received for 18.316

Seminar in combinatorics, graph theory, and discrete mathematics in general. Participants read and present papers from recent mathematics literature. Instruction and practice in written and oral communication provided. Enrollment limited.

Fall: T. Amdeberhan
Spring: D. J. Kleitman

18.305 Advanced Analytic Methods in Science and Engineering
Prereq: 18.04, 18.075, or 18.112
G (Fall)
3-0-9 H-LEVEL Grad Credit

A comprehensive treatment of the advanced methods of applied mathematics. Designed to strengthen the mathematical abilities of graduate students and train them to think on their own. Expansion around singular points: special functions; the WKB method on ordinary and partial differential equations; the method of stationary phase and the saddle point method; the two-scale method and the method of renormalized perturbation; singular perturbation and boundary-layer techniques.

H. Cheng
18.306 Advanced Partial Differential Equations with Applications
Prereq: 18.03; 18.04, 18.075, or 18.112
G (Spring)
3-0-9 H-LEVEL Grad Credit
R. R. Rosales

18.307 Integral Equations
Prereq: 18.04, 18.075, or 18.112
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Emphasis on concepts and techniques for solving integral equations from an applied mathematics perspective. Selection of material from the following topics: Volterra and Fredholm equations, Fredholm theory, the Hilbert-Schmidt theorem; Wiener-Hopf Method; Wiener-Hopf Method and partial differential equations; the Hilbert Problem and singular integral equations of Cauchy type; inverse scattering transform; group theory. Examples from fluid and solid mechanics, acoustics, quantum mechanics, and other applications.
Information: R. R. Rosales

18.308 Wave Motion
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Dispersive and non-dispersive waves in fluids, with emphasis on nonlinear effects and applications to Geophysical Flows and Nonlinear Acoustics. Stability of shear and stratified flows; surface and internal waves; nonlinear resonant interactions; solitons and solitary wave interactions; characteristics, nonlinear breaking, hydraulic jumps, and bores; weakly nonlinear theory; dispersive wave turbulence; weakly nonlinear geometrical optics and modulation; wave boundary layer phenomena.
D. J. Benney

18.310 Principles of Applied Mathematics
Prereq: 18.02
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9
Credit cannot also be received for 18.310C
Study of illustrative topics in discrete applied mathematics including sorting algorithms, information theory, coding theory, secret codes, generating functions, linear programming, game theory.
Information: D. J. Kleitman

18.310C Principles of Applied Mathematics (New)
Prereq: 18.02
U (Fall)
3-0-9
Credit cannot also be received for 18.310
Study of illustrative topics in discrete applied mathematics including sorting algorithms, information theory, coding theory, secret codes, generating functions, linear programming, and game theory. Instruction and practice in written communication provided. Same content as 18.310, but assignments are structured with an additional focus on writing.
D. J. Kleitman, P. W. Shor

18.311 Principles of Applied Mathematics
Prereq: 18.02; 18.03 or 18.034
U (Spring)
3-0-9
R. R. Rosales

18.312 Algebraic Combinatorics
Prereq: 18.700 or 18.701
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9
Applications of algebra to combinatorics and conversely. Topics include enumeration methods, partially ordered sets and lattices, matching theory, partitions and tableaux, algebraic graph theory, and combinatorics of polytopes.
Information: R. P. Stanley

18.314 Combinatorial Analysis
Prereq: 18.02, 18.06
U (Fall)
3-0-9
Combinatorial problems and methods for their solution. Enumeration, generating functions, recurrence relations, construction of bijections. Introduction to graph theory. Prior experience with abstraction and proofs is helpful.
A. Postnikov

18.315 Combinatorial Theory
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Content varies from year to year. Topics for Fall 2007: (1) Basic enumeration and (2) partially ordered sets.
R. P. Stanley

18.316 Seminar in Combinatorics
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Credit cannot also be received for 18.304
Content varies from year to year. Readings from current research papers in combinatorics. Topics to be chosen and presented by the class.
D. J. Kleitman

18.317 Combinatorics, Probability, and Computation on Groups
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Content varies from year to year. Covers a variety of classical and recent results on the subject. Topics include probability of generating a finite group; statistical group theory; random walks on finite and infinite groups; algorithms for permutation and black box groups; and generating random group elements.
Information: R. P. Stanley

18.318 Topics in Combinatorics
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Topics vary from year to year. Topic for spring 2008: Combinatorial Game Theory. Combinatorially defined games. Theory and interaction with combinatorial theory. Classical game theory,
take-away games, Grundy numbers, sums, number systems defined by games, surreal numbers. Interactions with Ramsey theory, probability, derandomization, communication, logic. Algorithmic questions.
C. D. Smyth

18.319 Combinatorics and Geometry
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Connections between combinatorics and geometry (and algebra). Discussion of combinatorial problems that arise in algebraic geometry, convex geometry, and algebraic topology. Topics include toric varieties, polytopes, fans, hyperplane arrangements, triangulations and tilings, matroids, topological combinatorics, Schubert calculus.
P. O. Persson

18.325 Topics in Applied Mathematics
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Topics vary from year to year.
Information: A. Toomre

18.330 Introduction to Numerical Analysis
Prereq: 18.02; 18.03 or 18.034
U (Spring)
3-0-9
Y. Farjoun

18.335J Introduction to Numerical Methods
(Same subject as 18.337J)
Prereq: 18.03, 18.06
G (Fall, Summer)
3-0-9 H-LEVEL Grad Credit
Advanced introduction to numerical linear algebra. Topics include direct and iterative methods for linear systems, eigenvalue decompositions and QR/SVD factorizations, stability and accuracy of numerical algorithms, the IEEE floating point standard, sparse and structured matrices, preconditioning, linear algebra software. Problem sets require some knowledge of Matlab.
P.-O. Persson

18.336 Numerical Methods for Partial Differential Equations
Prereq: 18.330, 18.335J, G (Spring)
3-0-9 H-LEVEL Grad Credit
Advanced introduction to applications and theory of numerical methods for solution of differential equations, especially of physically-arising partial differential equations, with emphasis on the fundamental ideas underlying various methods. Topics include finite differences, spectral methods, finite elements, well-posedness and stability, particle methods and lattice gases, boundary and nonlinear instabilities.
J.-C. Nave

18.337J Parallel Computing
(Same subject as 6.338J)
Prereq: 18.06
G (Spring)
3-0-9 H-LEVEL Grad Credit
Advanced interdisciplinary introduction to modern scientific computing on parallel supercomputers. Numerical topics include dense and sparse linear algebra, N-body problems, and Fourier transforms. Geometrical topics include partitioning and mesh generation. Other topics include architectures and software systems with emphasis on understanding the realities and myths of what is possible on the world’s fastest machines. Programming languages include MPI and Star-P with MATLAB.
Information: A. Edelman, J. K. White

18.338 Eigenvalues of Random Matrices
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
An introduction to the theory and applications of stochastic eigen-analysis. Theoretical topics include matrix calculus, “free” probability, and stochastic operators. Applications in signal processing, finance, and large stochastic systems are discussed. There is a hands-on emphasis on using the theory to discover new applications.
A. Edelman

18.353J Nonlinear Dynamics I: Chaos
(Same subject as 2.050J, 12.006J)
Prereq: 18.03, 8.02
U (Fall)
3-0-9
See description under subject 12.006J.
D. H. Rothman, T. Peacock

18.354J Nonlinear Dynamics II: Continuum Systems
(Same subject as 12.207J)
Prereq: 18.353J/12.006J or permission of instructor
U (Spring)
3-0-9 H (except for Course 18 students)
General mathematical principles of continuum systems. (1) From microscopic to macroscopic. Examples range from random walkers, to Newtonian mechanics, to option pricing. (2) Singular Perturbations. Examples include boundary layer theory, snow flakes and geophysical flows. (3) Instability. Generalize ideas from 18.353 to continuum systems. Examples from fluid mechanics, solid mechanics, astrophysics and biology. (4) Pattern formation and turbulence.
J. W. Bush

18.355 Fluid Mechanics
Prereq: 18.354J, 12.800, 2.25, or 16.121
G (Fall)
3-0-9 H-LEVEL Grad Credit
Topics include viscous flows, ideal flows, boundary layers, lubrication theory, Stokes flows, free-surface flows. Fundamental concepts illustrated through problems drawn from a variety of situations including animal locomotion (swimming and flying) and the dynamics of sport (the aerodynamics of sports balls, surfing, skiing). Particular emphasis on the power of dimensional analysis and scaling arguments. Course material supplemented by classroom and laboratory demonstrations.
E. Lauga

18.358 Nonlinear Fluid Mechanics
Prereq: 18.355 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
E. Lauga
18.361 Introduction to Modeling and Simulation
Engineering School-Wide Elective Subject.
(Offered under: 1.021, 2.088, 3.021, 10.333, 18.361, 22.00, HST:558)
Prereq: 18.03
U (Spring)
3-0-9 REST
See description under subject 22.00.
M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Radovitzky, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

18.366 Random Walks and Diffusion
Prereq: 18.305 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Mathematical modeling of diffusion phenomena: Central limit theorems, the continuum limit, Fokker-Planck equation, first passage, persistence and self avoidance, continuous-time random walks, Levy flights, random environments, advection-diffusion, diffusion-limited aggregation. Applications include polymers, turbulence, fractal growth, granular flow, and financial derivatives.
M. Z. Bazant

18.369 Mathematical Methods in Nanophotonics
Prereq: 18.305 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
High-level approaches to understanding complex optical media, structured on the scale of the wavelength, that are not generally analytically solvable. The basis for understanding optical phenomena such as photonic crystals and band gaps, anomalous diffraction, mechanisms for optical confinement, optical fibers (new and old), nonlinearities, and integrated optical devices. Methods covered include linear algebra and eigensystems for Maxwell’s equations, symmetry groups and representation theory, Bloch’s theorem, numerical eigensolver methods, time and frequency-domain computation, perturbation theory, and coupled-mode theories.
S. G. Johnson

18.376J Wave Propagation
(Same subject as 1.138J, 2.062J)
Prereq: 2.003J, 18.075
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.062J.
T. R. Akylas, C. C. Mei, R. R. Rosales

18.377J Nonlinear Dynamics and Waves
(Same subject as 1.685J, 2.034J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
A unified treatment of nonlinear oscillations and wave phenomena with applications to mechanical, optical, geophysical, fluid, electrical and flow-structure interaction problems. Nonlinear free and forced vibrations; nonlinear resonances; self-excited oscillations; lock-in phenomena. Nonlinear dispersive and nondispersive waves; resonant wave interactions; propagation of wave pulses and nonlinear Schrodinger equation. Nonlinear long waves and breaking; theory of characteristics; the Korteweg-de Vries equation; solitons and solitary wave interactions. Stability of shear flows. Some topics and applications may vary from year to year.
T. R. Akylas, C. C. Mei, R. R. Rosales

18.384 Undergraduate Seminar in Physical Mathematics (New)
Prereq: 18.311, 18.354, or permission of instructor
U (Spring)
3-0-9
The applied mathematics of continuous media and classical physics. Reading and presentation of papers from recent applied mathematics and physics literature. Topics and papers include fluid mechanics, solid mechanics, and biophysics. Enrollment limited.
E. Lauga

18.385J Nonlinear Dynamics and Chaos
(Same subject as 2.036J)
Prereq: 18.03 or 18.034
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to the modern theory of nonlinear dynamical systems with an emphasis on applications in science and engineering. Local and global existence of solutions to nonlinear dynamical systems, their dependence on initial data and parameters. Phase plane, limit cycles, Poincare-Bendixson theorem. Time-dependent systems, Floquet theory, Poincare maps, averaging. Stability of equilibria, near-equilibrium dynamics. Center manifolds, elementary bifurcations, normal forms. Introduction to chaos. Physical applications.
G. Haller, R. R. Rosales

18.386J Advanced Nonlinear Dynamics and Chaos
(Same subject as 2.037J)
Prereq: 18.385/2.036 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
G. Haller, R. R. Rosales

18.395 Group Theory with Applications to Physics
Prereq: 8.321
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Selection of topics from the theory of finite groups, Lie groups, and group representations, motivated by quantum mechanics and particle physics. 8.322 and 8.323 helpful.
Information: D. Z. Freedman

18.396J Supersymmetric Quantum Field Theories
(Same subject as 8.831J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Topics selected from the following: SUSY algebras and their particle representations; Weyl and Majorana spinors; Lagrangians of basic four-dimensional SUSY theories, both rigid SUSY and supergravity; supermultiplets of fields and superspace methods; renormalization properties, and the non-renormalization theorem; spontaneous breakdown of SUSY; and phenomenological SUSY theories. Some prior knowledge of Noether’s theorem, derivation and use of Feynman rules, I-loop renormalization, and gauge theories is essential.
Information: D. Z. Freedman
THEORETICAL COMPUTER SCIENCE

18.400J Automata, Computability, and Complexity
(Same subject as 6.045J)
Prereq: 6.042]
U (Spring)
4-0-8
See description under subject 6.045J.
S. Micali

18.404J Theory of Computation
(Same subject as 6.840J)
Prereq: 18.310 or 18.062J
G (Fall)
4-0-8 H-LEVEL Grad Credit (H except 18)
A more extensive and theoretical treatment of the material in 6.045J/18.400J, emphasizing computability and computational complexity theory. Regular and context-free languages. Decidable and undecidable problems, reducibility, recursive function theory. Time and space measures on computation, completeness, hierarchy theorems, inherently complex problems, oracles, probabilistic computation, and interactive proof systems.
M. Sipser

18.405J Advanced Complexity Theory
(Same subject as 6.841J)
Prereq: 6.840J/18.404J
G (Spring)
3-0-9 H-LEVEL Grad Credit
Information: M. Sudan, M. X. Goemans

18.409 Topics in Theoretical Computer Science
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Study of areas of current interest in theoretical computer science. Topics vary from term to term. Topic for fall 2007: An algorithmist’s toolkit. Topic for spring 2008: Aspects of quantum information and quantum computation. 18.435 or equivalent helpful.
Fall: J. Kelner
Spring: P. W. Shor

18.410J Design and Analysis of Algorithms
(Same subject as 6.046J)
Prereq: 6.006 (alternatively: 6.001; 6.042/18.062 or 18.310)
U (Fall, Spring)
4-0-8
See description under subject 6.046J.
C. E. Leiserson, M. Goemans

18.415J Advanced Algorithms
(Same subject as 6.854J)
Prereq: 6.041 or 6.042J; 6.046J
G (Fall)
5-0-7 H-LEVEL Grad Credit
See description under subject 6.854J.
D. R. Karger

18.416J Randomized Algorithms
(Same subject as 6.856J)
Prereq: 6.854J, 6.041 or 6.042J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
5-0-7 H-LEVEL Grad Credit
See description under subject 6.856J.
D. R. Karger

18.417 Introduction to Computational Molecular Biology
Prereq: 6.001; 18.410J/6.046J, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduces the basic computational methods used to model and predict the structure of biomolecules (proteins, DNA, RNA). Covers classical techniques in the field (molecular dynamics, Monte Carlo, dynamic programming) to more recent advances in analyzing and predicting RNA and protein structure, ranging from Hidden Mar-kov Models and 3-D lattice models to attribute Grammars and tree Grammars.
J. Waldispühl

18.418 Topics in Computational Molecular Biology
Prereq: 18.417 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Covers current research topics in computational molecular biology. Recent research papers presented from leading conferences such as the SIGACT International Conference on Computational Molecular Biology (RECOMB). Topics include original research (both theoretical and experimental) in comparative genomics, sequence and structure analysis, molecular evolution, proteomics, gene expression, transcriptional regulation, and biological networks. Recent research by course participants also covered. Participants will be expected to present either group or individual projects to the class.
B. Berger

18.419 Seminar in Theoretical Computer Science
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Advanced topics in theoretical computer science. Current literature presented by students and instructors with a view toward preparing students for research in theoretical computer science, and for developing the skills needed to present such results effectively.
Information: A. Toomre

18.424 Seminar in Information Theory
Prereq: 18.05, 18.440 or 6.041; 18.06, 18.700, or 18.701
U (Spring)
3-0-9
Considers various topics in information theory, including data compression, Shannon’s Theorems, and error-correcting codes. Students present and discuss the subject matter. Instruction and practice in written and oral communication provided. Enrollment limited.
P. W. Shor

M A T H E M A T I C S
18.425J Cryptography and Cryptanalysis
(Same subject as 6.875J)
Prereq: 6.046J
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 6.875J.
S. Goldwasser

18.426J Advanced Topics in Cryptography
(Same subject as 6.876J)
Prereq: 6.875J/18.425J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
See description under subject 6.876J.
S. Goldwasser

18.433 Combinatorial Optimization
Prereq: 18.06 or 18.700
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 H except 18
Thorough treatment of linear programming and combinatorial optimization. Topics include matching theory, network flow, matroid optimization, and how to deal with NP-hard optimization problems. Prior exposure to discrete mathematics (such as 18.310) helpful.
Information: P. W. Shor

18.434 Seminar in Theoretical Computer Science
Prereq: 18.404, 18.410
U (Spring)
3-0-9
Topics vary from year to year. Students present and discuss the subject matter. Instruction and practice in written and oral communication provided. Enrollment limited.
Information: M. X. Goemans

18.435J Quantum Computation
(Same subject as 2.111J, ESD.79J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Provides an introduction to the theory and practice of quantum computation. Topics covered: physics of information processing; quantum algorithms including the factoring algorithm and Grover’s search algorithm; quantum error correction; quantum communication and cryptography. Knowledge of quantum mechanics helpful but not required.
E. Farhi, S. Lloyd, P. Shor

18.437J Distributed Algorithms
(Same subject as 6.852J)
Prereq: 6.046
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 6.852J.
N. A. Lynch

APPLIED MATHEMATICS: STATISTICS

18.440 Probability and Random Variables
Prereq: 18.02
U (Fall, Spring)
3-0-9
Fall: D. Gutfreund
Spring: J. Kelner

18.443 Statistics for Applications
Prereq: 18.440 or 6.041
U (Fall, Spring)
3-0-9 H (except for Course 18 students)
A broad treatment of statistics, concentrating on specific statistical techniques used in science and industry. Topics: hypothesis testing and estimation. Confidence intervals, chi-square tests, nonparametric statistics, analysis of variance, regression, correlation, decision theory, and Bayesian statistics.
R. M. Dudley

18.445 Introduction to Stochastic Processes
Prereq: 18.100; 18.440 or 6.041
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduces the theory and application of stochastic processes. Emphasis on Markov chains, Markov processes, and their ergotic theory.
D. W. Stroock

18.447 Probabilistic Methods in Combinatorics and Algorithms
Prereq: 18.310 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Probabilistic methods are used extensively in combinatorics and in the study of algorithms in computer science. This course develops some of the basic tools and illustrates their use via examples. Topics include the probabilistic method of Erdős and the theory of random graphs.
Information: C. D. Smyth

18.465 Topics in Statistics
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Topics vary from year to year.
R. M. Dudley

18.466 Mathematical Statistics
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Decision theory, estimation, confidence intervals, hypothesis testing. Introduces large sample theory. Asymptotic efficiency of estimates. Exponential families. Sequential analysis.
Information: R. M. Dudley

Civil and Environmental Engineering: 1.151, 1.155,1.201J, 1.203J, 1.205J
Electrical Engineering and Computer Science:
6.041,6.231, 6.245, 6.262, 6.431, 6.432, and 6.435
Management: 15.034, 15.061, 15.065, 15.070, 15.075,15.076, 15.098, and 15.306
Mathematics: 18.05, 18.175, 18.177, 18.440, 18.441,18.443, 18.445, 18.458, and 18.465
See also: 2.061, 2.830, 5.70, 5.72, 7.02, 8.044, 8.08,10.816, 11.220, 11.221, 16.322, 17.872, 17.874, 22.38, HST.191, and MAS.622J.

LOGIC

18.504 Seminar in Logic
Prereq: 18.100; 18.700 or 18.701
U (Spring)
3-0-9
Students present and discuss the subject matter taken from current journals or books. Topics vary from year to year. Instruction and practice in written and oral communication provided. Enrollment limited.
Information: H. Rogers
18.510 Introduction to Mathematical Logic and Set Theory
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9
Credit cannot also be received for 18.511
Zermelo-Fraenkel set theory. Ordinals and cardinals. Axiom of choice and transfinite induction. Propositional and predicate logic. Elementary model theory: completeness, compactness, and Lowenheim-Skolem theorems. Gödel incompleteness theorem. 18.510 and 18.511 are offered in alternate years; they may not both be taken for credit.
Information: H. Rogers

18.511 Introduction to Mathematical Logic and Recursion Theory
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9
Credit cannot also be received for 18.510
Propositional and predicate logic. Elementary model theory: completeness, compactness, and Lowenheim-Skolem theorems. Elementary recursion theory: enumeration and recursion theorems. Post's Problem. Gödel incompleteness theorem. 18.511 and 18.510 are offered in alternate years; they may not both be taken for credit.
E. Rosen

18.515 Mathematical Logic
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
H. Rogers

18.565 Recursion Theory
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Topics in recursion theory chosen from priority arguments, hyperarithmetical recursion, ordinal recursion, E-recursion, theory of projective sets. A previous subject in logic recommended but not required.
R. Shore

18.575 Model Theory
Prereq: 18.510, 18.511, or 18.515
G (Spring)
3-0-9 H-LEVEL Grad Credit
Compactness theorem, ultraproducts, quantifier elimination, model completeness, Lowenheim-Skolem theorem, omitting types theorem, atomic and prime models, saturated and homogeneous models, indiscernibles, countable models, Morley's theorem, Baldwin-Lachlan theorem, omega-stability, forking and independence, model theory of algebraically closed and real closed fields, applications to algebra.
E. Rosen

18.585 Set Theory
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Topics in set theory chosen from large cardinals, combinatorial set theory, forcing, descriptive set theory, fine structure theory.
Information: H. Rogers

ALGEBRA AND NUMBER THEORY

18.700 Linear Algebra
Prereq: 18.02
U (Fall)
3-0-9 REST
Credit cannot also be received for 18.06
A rigorous treatment of linear algebra, including vector spaces, systems of linear equations, bases, linear independence, matrices, determinants, eigenvalues, inner products, quadratic forms, and canonical forms of matrices. Compared with 18.06, more emphasis on theory and proofs.
J. L. Kim

18.701 Algebra I
Prereq: 18.700, 18.100B, 18.100C or permission of instructor
U (Fall)
3-0-9
18.702 Algebra II
Prereq: 18.701
U (Spring)
3-0-9
More extensive and theoretical than the 18.700-18.703 sequence. Experience with proofs helpful. First term: group theory, geometry, and linear algebra. Second term: group representations, rings, ideals, fields, polynomial rings, modules, factorization, integers in quadratic number fields, field extensions, Galois theory.
M. Artin

18.703 Modern Algebra
Prereq: 18.02
U (Spring)
3-0-9
A one-term treatment, covering the traditional algebra topics that have found greatest application in science and engineering as well as in mathematics: group theory, emphasizing finite groups; ring theory, including ideals and unique factorization in polynomial and Euclidean rings; field theory, including properties and applications of finite fields. 18.700 and 18.703 together form a standard algebra sequence.
V. G. Kac

18.704 Seminar in Algebra
Prereq: 18.06, 18.700, or 18.701
U (Fall, Spring)
3-0-9
Topics vary from year to year. Students present and discuss the subject matter. Instruction and practice in written and oral communication provided. Some experience with proofs required. Topic for fall 2007: Computational algebra and algebraic geometry. Enrollment limited.
Fall: S. Kleiman
Spring: J. L. Kim

18.705 Commutative Algebra
Prereq: 18.702 or 18.703
G (Fall)
3-0-9 H-LEVEL Grad Credit
Basic topics in commutative algebra: Noetherian rings and modules, Hilbert basis theorem, Cayley-Hamilton theorem, integral dependence, Noether normalization, the Nullstellensatz, localization, primary decomposition, DVRs, filtrations, length, Artin rings, Hilbert polynomials, tensor products, and dimension theory.
S. Kleiman

18.706 Noncommutative Algebra
Prereq: 18.705
G (Spring)
3-0-9 H-LEVEL Grad Credit
Wedderburn theory, Morita equivalence, localization and Goldie's theorem central simple algebras and the Brauer group, maximal orders, representations, polynomial identity rings, invariant theory growth of algebras, Gelfand-Kirillov dimension.
P. I. Etingof
Part 552

Information: G. Lusztig

2007–2008

18.725 Algebraic Geometry
Prereq: 18.705
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.726 Algebraic Geometry
Prereq: 18.725
G (Spring)
3-0-9 H-LEVEL Grad Credit

18.727 Topics in Algebraic Geometry
Prereq: 18.725
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

18.735 Topics in Algebra
Prereq: 18.702, 18.703, or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

18.737 Algebraic Groups
Prereq: 18.705
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

18.745 Introduction to Lie Algebras
Prereq: 18.701 or 18.703
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.747 Infinite-dimensional Lie Algebras
Prereq: 18.745
G (Spring)
3-0-9 H-LEVEL Grad Credit

18.748 Algebraic Number Theory
Prereq: 18.706
G (Spring)
3-0-9 H-LEVEL Grad Credit

18.755 Introduction to Lie Groups
Prereq: 18.100B; 18.700 or 18.701
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.756 Lie Groups and Lie Algebras
Prereq: 18.745
G (Spring)
3-0-9 H-LEVEL Grad Credit

18.757 Representations of Lie Groups
Prereq: 18.745
G (Spring)
3-0-9 H-LEVEL Grad Credit

18.758 Representations of Lie Groups
Prereq: 18.757
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

18.769 Topics in Lie Theory
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

18.781 Theory of Numbers
Prereq: —
U (Fall)
3-0-9

18.784 Seminar in Number Theory (New)
Prereq: 18.06 and 18.100; or 18.700 or 18.701
U (Fall, Spring)
3-0-9

18.785 Analytic Number Theory
Prereq: 18.112
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

18.786 Algebraic Number Theory
Prereq: 18.100B or 18.100C; 18.702
G (Spring)
3-0-9 H-LEVEL Grad Credit

18.795 Topics in Algebraic Geometry
Prereq: 18.705
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.796 Topics in Algebraic Geometry
Prereq: 18.705
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.797 Topics in Algebraic Geometry
Prereq: 18.705
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.798 Topics in Algebraic Geometry
Prereq: 18.705
G (Fall)
3-0-9 H-LEVEL Grad Credit

18.799 Topics in Algebraic Geometry
Prereq: 18.705
G (Fall)
3-0-9 H-LEVEL Grad Credit
**18.787 Topics in Number Theory (New)**
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Content varies from year to year. Topic for fall 2007: theory of p-adic ordinary differential equations; applications to p-adic Hodge theory, zeta functions of algebraic varieties.

*K. S. Kedlaya*

**18.821 Project Laboratory in Mathematics**
Prereq: Two mathematics subjects numbered 18.100 or above
U (Fall, Spring)
0-6-6 Institute LAB

Guided research in mathematics, employing the scientific method. Students confront puzzling and complex mathematical situations, through the acquisition of data by computer, pencil and paper, or physical experimentation, and attempt to explain them mathematically. Students choose three projects from a large collection of options. Each project results in a laboratory report subject to revision; oral presentation on one report in a course conference. Projects drawn from many areas, including dynamical systems, number theory, algebra, fluid mechanics, asymptotic analysis, knot theory, and probability. Limited enrollment.

*Fall: D. A. Vogan*
*Spring: P. Seidel*

### TOPOLOGY AND GEOMETRY

**18.901 Introduction to Topology**
Prereq: 18.100B, 18.100C, or permission of instructor
U (Fall, Spring)
3-0-9 H (except for Course 18 students)

Introduces topology, covering topics fundamental to modern analysis and geometry. Topological spaces and continuous functions, connectedness, compactness, separation axioms, and selected further topics such as function spaces, metrization theorems, embedding theorems, dimension theory.

*Fall: J. R. Munkres*
*Spring: Staff*

**18.904 Seminar in Topology**
Prereq: 18.901
U (Fall)
3-0-9

Students present and discuss the subject matter with faculty guidance. Topics include the fundamental group and covering spaces. Instruction and practice in written and oral communication provided. Enrollment limited.

*P. Cheung*

**18.905 Algebraic Topology I**
Prereq: 18.701 or 18.703; 18.901
G (Fall)
3-0-9 H-LEVEL Grad Credit

Review of fundamental group and covering spaces; simplicial, cellular, and singular homology; universal coefficient and Künneth theorems; cohomology, cup product; Poincaré duality.

*M. J. Behrens*

**18.906 Algebraic Topology II**
Prereq: 18.905
G (Spring)
3-0-9 H-LEVEL Grad Credit

Continues the introduction to algebraic topology from 18.905. Topics include basic homotopy theory, spectral sequences, characteristic classes, and cohomology operations.

*L. Hesselholt*

**18.915 Graduate Topology Seminar**
Prereq: 18.906
G (Fall)
3-0-9 H-LEVEL Grad Credit

Study and discussion of important original papers in the various parts of algebraic topology. Open to all students who have taken 18.906 or the equivalent, not only prospective topologists.

*H. R. Miller*

**18.917 Topics in Algebraic Topology**
Prereq: 18.906
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Content varies from year to year. Introduces new and significant developments in algebraic topology with the focus on homotopy theory and related areas.

*Fall: J. Lurie*
*Spring: M. J. Behrens*

**18.937 Topics in Geometric Topology**
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Content varies from year to year. Introduces new and significant developments in geometric topology.

*Information: T. S. Mrowka*

**18.950 Differential Forms**
Prereq: 18.100; 18.101 or 18.901
U (Fall)
3-0-9 (except for Course 18 students)

An introduction to differential geometry. Metrics, Lie bracket, connections, geodesics, tensors, intrinsic and extrinsic curvature are studied on abstractly defined manifolds using coordinate charts. Curves and surfaces in three dimensions are studied as important special cases. Gauss-Bonnet theorem for surfaces and selected introductory topics in special and general relativity are also studied. 18.100 is required, 18.101 is strongly recommended, and 18.901 would be helpful.

*R. Seidel*

**18.952 Theory of Differential Forms**
Prereq: 18.101; 18.700 or 18.701
U (Spring)
3-0-9

Multilinear algebra: tensors and exterior forms. Differential forms on $\mathbb{R}^n$: exterior differentiation, the pull-back operation and the Poincaré lemma. Applications to physics: Maxwell's equations from the differential form perspective. Integration of forms on open sets of $\mathbb{R}^n$. The change of variables formula revisited. The degree of a differentiable mapping. Differential forms on manifolds and De Rham theory. Integration of forms on manifolds and Stokes' theorem. The push-forward operation for forms. Thom forms and intersection theory. Applications to differential topology.

*B. D. Parker*

**18.965 Geometry of Manifolds**
Prereq: 18.101, 18.905
G (Fall)
3-0-9 H-LEVEL Grad Credit

**18.966 Geometry of Manifolds**
Prereq: 18.965, 18.906
G (Spring)
3-0-9 H-LEVEL Grad Credit

Differential forms, introduction to Lie groups, the DeRham theorem, Riemannian manifolds, curvature, the Hodge theory. 18.966 is a con-
tinuation of 18.965 and focuses more deeply on various aspects of the geometry of manifolds. Contents vary from year to year, and can range from Riemannian geometry (curvature, holonomy) to symplectic geometry, complex geometry and Hodge-Kahler theory, or smooth manifold topology.
*Fall: M. E. Gualtieri
*Spring: D. S. Auroux

18.969 Topics in Geometry
Prereq: 18.965
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Content varies from year to year. Topics for fall 2007: Introduction to Ozsvath-Szabo (Heegaard) Floer homology. Topics will include a brief introduction to Lagrangian Floer homology, construction of three and four-manifold invariants introduced by Ozsvath and Szabo as a special case of Lagrangian Floer homology, knot and link Floer homology invariants and their relationship to the three and four-manifold invariants, and applications of these invariants to contact geometry, knot theory, and three-manifold topology and geometry.
*M. E. Hedden

18.979 Graduate Geometry Seminar
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Content varies from year to year. Fall 2007: Symplectic Topology. Topic is either generalized Lagrangian Floer theory (as A_\infty algebras) or Lagrangian correspondences and pseudoholomorphic quilts.
*K. Wehrheim

18.994 Seminar in Geometry
Prereq: 18.101
U (Spring)
3-0-9
Students present and discuss subject matter taken from current journals or books. Topics vary from year to year. Instruction and practice in written and oral communication provided. Enrollment limited.
*V. W. Guillemin

18.995–18.998 Special Topics in Mathematics
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for group study of advanced subjects in mathematics not otherwise included in the curriculum. Offerings are initiated by members of the Mathematics faculty on an ad hoc basis, subject to departmental approval.
*Information: H. R. Miller

18.999 Research in Mathematics
Prereq: —
G (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Opportunity for study of graduate-level topics in mathematics under the supervision of a member of the department. For graduate students desiring advanced work not provided in regular subjects.
*Information: D. S. Jerison, G. Staffilani

18.UR Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Undergraduate research opportunities in mathematics. Permission required in advance to register for this subject. For further information, consult the departmental coordinator.
*Information: H. R. Miller

18.ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of a PhD thesis; to be arranged by the student and an appropriate MIT faculty member.
*Information: D.S. Jerison, G. Staffilani

18.CME Study at Cambridge University
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Provides credit for students studying at Cambridge University under the Undergraduate Student Exchange Program of the Cambridge-MIT Institute. Credit may be used to satisfy specific SB degree requirements. Consult with department and CME office.
*H. R. Miller
20.020 Introduction to Biological Engineering Design (New)
Prereq: —
U (Spring)
2-6-4
A project-based introduction to the engineering of synthetic biological systems. Throughout the term, students develop projects that are responsive to real-world problems of their choosing, and whose solutions depend on biological technologies. Lectures, discussions, and studio exercises will introduce (1) components and control of prokaryotic and eukaryotic behavior, (2) DNA synthesis, standards, and abstraction in biological engineering, and (3) issues of human practice, including biological safety; security; ownership, sharing, and innovation; and ethics. Preference to freshmen.
D. Endy, N. Kuldell

20.102 Macroeconomics and Population Genomics
(Same subject as 1.084J)
Prereq: 7.011, 7.012, 7.013, 7.014, or 7.015; 5.111, 5.112, or 3.091
U (Fall)
2-8-5 Institute LAB
Can be repeated for credit

20.104 Evolutionary Risk for Common Disease
(Same subject as 1.081J, ESD.053J)
Prereq: 3-0-9

20.105j Systems Microbiology
(Same subject as 1.084J)
Prereq: 5.111, 5.112 or 3.091; 7.012, 7.013, 7.014, or 7.015
U (Fall)
3-0-9
Introductory microbiology from a systems perspective. Considers microbial diversity, population dynamics, and genomics. Emphasize the delicate balance between microbes and humans, and changes that result in the emergence of infectious diseases and antimicrobial resistance. Case study approach covers topics such as vaccines, toxins, biodefense, and infections including Legionnaire’s disease, tuberculosis, Helicobacter pylori, and plague.
D. B. Schauer, E. DeLong

20.109 Laboratory Fundamentals in Biological Engineering
Prereq: 7.012, 7.013, 7.014, or 7.015; 5.111, 5.112, or 3.091; and permission of instructor
U (Fall, Spring)
2-8-5 Institute LAB
Introduces experimental biochemical and molecular techniques from a quantitative engineering perspective. Experimental design, rigorous data analysis, and scientific communication form the underpinnings of this subject. Discovery-based experimental modules focus on (1) DNA Engineering in which students design, construct, and use genetic material, (2) Parts Engineering which emphasizes protein design and quantitative assessment of protein performance, (3) System Engineering in which students consider genome-wide consequences of genetic perturbations, (4) Biomaterial Engineering in which students use biologically-encoded devices to design and build materials. Limited enrollment. Priority given to BE majors.
Fall: A. Belcher, D. Endy, N. Kuldell, A. Stachowiak
Spring: B. P. Engelward, A. Jasanoff, N. Kuldell, A. Stachowiak

20.200 Biological Engineering Seminar
Prereq: Open only to BE graduate students, or by permission of instructor
G (Fall, Spring)
1-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Weekly one-hour seminars covering graduate student research and presentations by invited speakers.
J. S. Wishnok

20.201 Mechanisms of Drug Actions
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Chemical and biological analysis of the metabolism and distribution of drugs, toxins and chemicals in animals and humans, and the mechanism by which they cause therapeutic and toxic responses. Metabolism and toxicity as a basis for drug development. Metabolic polymorphisms and biomarkers of exposure.
P. C. Dedon, S. R. Tannenbaum

20.202 Animal Models in Toxicology
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
1-1-4 H-LEVEL Grad Credit
Selected aspects of anatomy, histology, immunocytochemistry, in situ hybridization,
20.213 DNA Damage and Genomic Instability
Prereq: 5.07, 7.05, permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit

Recent progress has resulted in the identification of dozens of genes that, when mutated, promote tumorigenesis. However, it is not yet clear what causes these mutations. Subject analyzes the chemistry of DNA damaging agents, and continues with analysis of the mutagenic and toxic consequences of modifications to DNA structure. The contrasting perspective that normal DNA processing leads to mutations is also presented. The biochemistry and molecular mechanisms of DNA replication, DNA repair, and recombination form the foundation of the subject.

P. C. Dedon, B. P. Engelward

20.215 Epidemiology, Population Genetics and Cell Biology of Human Cancers
(Subject meets with 20.102)
Prereq: 18.02, 1.00
G (Fall)
3-0-15 H-LEVEL Grad Credit

Logic and technology needed to discover genetic and environmental causes and accelerating factors for common human cancers. Analyses of large organized historical public health databases using quantitative carcinogenesis cascade models. Java-based model construction for mono- and multi-genic inherited risk for late onset (sporadic) cancers. Analyses of historical and clinical data to define role of environmental risk factors. Graduate students complete additional work.

W. G. Thilly

20.217 Adult Stem Cell Biological Engineering
Prereq: 7.012, 7.013, 7.014, or 7.015; 5.07 or 7.05
G (Spring)
2-0-4 H-LEVEL Grad Credit

Fundamental properties of stem cells are considered with a major focus on the role of adult stem cells in normal mammalian tissue function, aging, and disease states. Biological engineering approaches to the problems of identifying and expanding adult stem cells for biotechnology and biomedicine are addressed. Fundamental aspects of mammalian tissue cell kinetics are examined from the perspective of how individual cellular processes (e.g., mitosis, apoptosis, differentiation) are integrated in higher order cell kinetics from the embryo to the adult mammal. Lectures are complemented with student presentations of original research articles in the fields of tissue cell kinetics, stem cell biology, aging, and cancer. Offered first half of term.

J. L. Sherley

20.219 Selected Topics in Toxicology
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Detailed discussion of selected topics of current interest. Classwork in various areas not covered by regular subjects.

Staff

20.309 Biological Engineering II: Instrumentation and Measurement
(Subject meets with 20.409)
Prereq: 18.03
U (Fall, Spring)
3-6-3

Sensing and measurement aimed at quantitative molecular/cell/tissue analysis in terms of genetic, biochemical, and biophysical properties. Methods include light and fluorescence microscopies, and electro-mechanical probes (atomic force microscopy, optical traps, MEMS devices). Application of statistics, probability, signal and noise analysis, and Fourier techniques to experimental data. Preferences given to juniors and seniors.

Fall: S. Manalis, P. T. So, M. Shusteff
Spring: M. J. Lang, K. Van Vliet, E. Boyden

20.310 Molecular, Cellular, and Tissue Biomechanics
(Same subject as 2.797J; 3.053J, 6.024J)
Prereq: 18.03 or 3.016; 7.012, 7.013, 7.014, or 7.015; 2.370 or 2.772
U (Spring)
4-0-8

See description under subject 2.797].

M. J. Lang, R. D. Kamm

20.320 Analysis of Biomolecular & Cellular Systems
Prereq: 20.110J/2.772J; 18.03; 6.00; 5.07/7.05
U (Fall)
4-0-8

Analysis of molecular and cellular processes across a hierarchy of scales, including genetic, molecular, cellular, and cell population levels.

Topics include gene sequence analysis, molecular modeling, metabolic and gene regulation networks; signal transduction pathways; cell populations in tissues and bioreactors. Emphasis on experimental methods, quantitative analysis, and computational modeling.

F. White, E. Fraenkel
20.360J Tissue Engineering for Analysis, Prevention, and Treatment of Human Disease
Prereq: 5.07 or 7.05; 7.03; 18.03; 20.110 or 5.60
U (Spring)
3-0-6
Analysis of fundamental processes in tissue engineering with an emphasis on use of comparative animal models and in vitro tissue engineered models to understand human disease and develop therapies for human disease and for regenerating human tissues and organs. Using representative examples of metabolic tissue (e.g., liver) and connective tissue (e.g., bone). Design principles and engineering approaches (e.g., use of synthetic materials) for controlling receptor-mediated processes such as cell migration, growth, and differentiation. Mass transfer limitations in design of devices for cell encapsulation and in scaffold-guided regeneration. Guided organization of multicellular structures. Current clinical prospects.
L. G. Griffith, J. G. Fox, D. Schauer

20.361J Molecular and Engineering Aspects of Biotechnology
(Same subject as 7.37J, 10.44J)
Prereq: 20.110/2.772, 2.005, 3.012, or 5.60; 7.06; or permission of instructor
U (Spring)
4-0-8
See description under subject 7.37J.
H. Lodish, L. G. Griffith

20.370J Quantitative Physiology: Cells and Tissues
(Same subject as 2.791J, 6.02J)
(Subject meets with 2.794J, 6.52J, 20.470J, HST.541J)
Prereq: 8.02; 18.03; 2.005, 6.002, 6.003, 6.071, 10.301, or permission of instructor
U (Fall)
5-2-5
See description under subject 6.02J.
D. M. Freeman, J. Han

20.371J Quantitative Physiology: Organ Transport Systems
(Same subject as 2.792J, 6.022J, HST.542J)
(Subject meets with 2.796J, 6.522J, 20.471J)
Prereq: 18.03, 8.02, or permission of instructor
U (Spring)
4-2-6
See description under subject 6.02J.
R. G. Mark, C. M. Stultz

20.380J Biological Engineering Design
(Same subject as 5.22J)
Prereq: 7.06, 20.309, 20.330
U (Spring)
5-0-7
Illustrates how knowledge and principles of biology, biochemistry, and engineering are integrated to create new products for societal benefit. Uses case-study format to examine recently developed products of pharmaceutical and biotechnology industries: how a product evolves from initial idea, through patents, testing, evaluation, production, and marketing. Emphasizes scientific and engineering principles, as well as the responsibility scientists, engineers, and business executives have for the consequences of their technology. Instruction and practice in written and oral communication provided. Enrollment limited.
J. M. Essigmann, R. Sasisakharan

20.390 Foundations of Computational and Systems Biology
(Subject meets with 7.36, 7.91J, 20.490J)
Prereq: 7.05 or 5.07; or 7.01x and 6.001; or permission of instructor
U (Spring)
3-0-9
Introduction to computational biology emphasizing the fundamentals of nucleic acid and protein sequence and structural analysis, as well as the analysis of complex biological systems. Principles and methods used for sequence alignment, motif finding, expression array analysis, structural modeling, structure prediction and network modeling. Techniques include dynamic programming, Markov models, clustering techniques, dead-end elimination and energy minimization approaches. Exposure to currently emerging research areas. Designed for advanced undergraduates and graduate students with strong backgrounds in either molecular biology or computer science. Some foundational material covering basic programming skills, probability and statistics is provided for students with non-quantitative backgrounds. Enrollment is limited to 60.
M. Yaffe, C. Burge, A. Keating

20.397J Perspectives in Biological Engineering
(Subject meets with 7.548J)
Prereq: Permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
An in-depth presentation of how engineering and biological approaches can be combined to solve problems in science and technology, emphasizing integration of biological information and methodologies with engineering analysis, synthesis, and design. Emphasis on molecular mechanisms underlying cellular processes, including signal transduction, gene expression networks, and functional responses. Enrollment restricted to Biological Engineering and Biology graduate students.
F. White, E. Fraenkel

20.409 Biological Engineering II: Instrumentation and Measurement (New)
(Subject meets with 2.673J, 20.309J)
Prereq: 18.03
G (Fall)
2-7-3
Sensing and measurement aimed at quantitative molecular/cell/tissue analysis in terms of genetic, biochemical, and biophysical properties. Methods include light and fluorescence microscopes, and electro-mechanical probes (atomic force microscopy, laser and magnetic traps, MEMS devices). Application of statistics, probability and noise analysis to experimental data. Enrollment limited to five graduate students.
S. Manalis, P. T. So, M. Shusteff

20.410J Molecular, Cellular, and Tissue Biomechanics
(Same subject as 2.798J, 3.971J, 6.524J, 10.537J)
Prereq: 7.012; 2.002, 2.006, 6.013, 6.014, 10.301, or 10.302
G (Spring)
3-0-9 H-LEVEL Grad Credit
Develops and applies scaling laws and the methods of continuum mechanics to biomechanical phenomena over a range of length scales. Topics include structure of tissues and the molecular basis for macroscopic properties; chemical and electrical effects on mechanical behavior; cell mechanics, motility and adhesion; biomembranes; biomolecular mechanics and molecular motors. Experimental methods for probing structures at the tissue, cellular, and molecular levels.
A. J. Grodzinsky, P. Doyle

20.411J Cell-Matrix Mechanics
(Same subject as 2.785J, 3.97J, HST.523J)
Prereq: 3.091 or 5.11 or 5.111 or 5.112; 2.005 or 5.60; 7.012, 7.013, 7.014, or 7.015
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.785J.
I. V. Yannas, M. Spector
20.420j Biomolecular Kinetics and Cellular Dynamics  
(Prereq: 5.60 or permission of instructor) 
G (Spring) 3-0-9 H-LEVEL Grad Credit

Fundamental analysis of biological rate processes in terms of approaches based in biomolecular reaction kinetics and systems engineering algorithms. Topics include binding and hybridization interactions, enzyme reactions, metabolic cycles, gene regulation, receptor/ligand systems, intra- and inter-cellular signaling, and cell population dynamics. 

D. Lauffenburger, K. D. Wittrup

20.430j Fields, Forces, and Flows in Biological Systems  
(Prereq: 3.01, 8.02, 10.302, or permission of instructor) 
G (Fall) 3-0-9 H-LEVEL Grad Credit

Molecular diffusion, diffusion-reaction, conduction, convection in biological systems; fields in heterogeneous media; electric double layers; Maxwell stress tensor, electrical forces in physiological systems. Fluid and solid continua: equations of motion useful for porous, hydrated biological tissues. Case studies of membrane transport, electrode interfaces, electrical, mechanical, and chemical transduction in tissues, convective-diffusion/reaction, electrophoretic, electroosmotic flows in tissues/MEMS, and ECG. Electromechanical and physicochemical interactions in cells and biomaterials; musculoskeletal, cardiovascular, and other biological and clinical examples. 

A. J. Grodzinsky, R. D. Wittrup

20.440 Analysis of Biological Networks  
(Prereq: Permission of instructor) 
G (Fall) 4-0-8 H-LEVEL Grad Credit

Analyzes complex biological processes from the molecular, cellular, extracellular, and organ levels of hierarchy. Emphasis placed on the basic biochemical and biophysical principles that govern these processes. Examples of processes to be studied include chemotaxis, the fixation of nitrogen into organic biological molecules, growth factor and hormone mediated signaling cascades, and signaling cascades leading to cell death in response to DNA damage. In each case, the availability of a resource, or the presence of a stimulus, results in some biochemical pathways being turned on while others are turned off. Examines the dynamic aspects of these processes and details how biochemical mechanistic themes impinge on molecular-cellular-tissue-organ level functions. Chemical and quantitative view of the interplay of multiple pathways as biological networks. Preparation of a unique grant application in an area of biological networks. 

J. Essigmann, R. Sasisekharan

20.441j Biomaterials: Tissue Interactions  
(Prereq: 3.091; 5.111 or 5.112; 2.005 or 5.60; 7.012 or 7.013) 
G (Fall) 3-0-9 H-LEVEL Grad Credit

Principles of materials science and cell biology underlying the design of medical implants, artificial organs, and matrices for tissue engineering. Methods for biomaterials surface characterization and analysis of protein adsorption on biomaterials. Molecular and cellular interactions with biomaterials are analyzed in terms of unit cell processes, such as matrix synthesis, degradation, and contraction. Mechanisms underlying wound healing and tissue remodeling following implantation in various organs. Tissue and organ regeneration. Design of implants and prostheses based on control of biomaterials-tissue interactions. Comparative analysis of intact, biodegradable, and bioreplaceable implants by reference to case studies. Criteria for restoration of physiological function for tissues and organs. 

I. V. Yannas, M. Spector

20.442 Molecular Structure of Biological Materials  
(Subject meets with 20.342) 
Prereq: 5.07 or 7.05; permission of instructor 
G (Fall) 3-0-9

Graduate students are expected to complete additional coursework. 

S. Zhang

20.450 Molecular and Cellular Pathophysiology  
(Prereq: 20.420 and 20.440, or permission of instructor) 
G (Spring) 3-0-9 H-LEVEL Grad Credit

Fundamentals of tissue and organ response to injury are examined from a molecular and cellular perspective. Special emphasis on disease states that bridge infection, inflammation, immunity, and cancer. Systems approach to pathophysiology includes lectures, critical evaluation of recent scientific papers, and student projects and presentations. 

D. B. Schauer, L. Samson

20.451j Design of Medical Devices and Implants  
(Prereq: 3.01, 3.961, 5.724) 
G (Spring) 3-0-9 H-LEVEL Grad Credit

See description under subject 2.782J. 

I. V. Yannas, M. Spector

20.453j Biomedical Information Technology  
(Prereq: 2.771J, HST.958J) 
G (Fall) 3-0-9 H-LEVEL Grad Credit

Design of contemporary information systems for biological and medical data. Examples chosen from biology and medicine to illustrate complete life cycle information systems, beginning with data acquisition, following to data storage and finally to retrieval and analysis. Design of appropriate databases, client-server strategies, data interchange protocols, and computational modeling architectures. Students are expected to have some familiarity with scientific application software and a basic understanding of at least one contemporary programming language (e.g. C, C++, Java, Lisp, Perl, Python). A major term project is required of all students. Open to motivated seniors having a strong interest in biomedical engineering and information system design with the ability to carry out a significant independent project. 

C. F. Dewey, Jr., S. Bhowmik (NTU, Singapore)

20.462j Molecular Principles of Biomaterials  
(Prereq: 3.962J) 
G (Spring) 3-0-9 H-LEVEL Grad Credit

Analysis and design at a molecular scale of materials used in contact with biological systems, including biotechnology and biomedical engineering. Topics include molecular interactions between bio- and synthetic molecules and surfaces; design, synthesis, and processing approaches for materials that control cell functions; and application of state-of-the-art materials science to problems in tissue engineering, drug delivery, biosensors, and cell-guiding surfaces. 

D. J. Irvine

20.465j Statistical Thermodynamics with Applications to Biological Systems  
(Prereq: 5.60 or permission of instructor) 
G (Fall) 4-0-8 H-LEVEL Grad Credit

See description under subject 5.70J. 

A. Chakraborty, J. M. Deutch
20.470j Quantitative Physiology: Cells and Tissues
(Same subject as 2.794j, 6.521j, HST.541j)
Prereq: 2.003, 6.002, 6.071, or 10.301; 8.02, 18.03
G (Fall)
5-2-5
See description under subject 6.521j.
D. M. Freeman, J. Han

20.471j Quantitative Physiology: Organ Transport Systems
(Same subject as 2.796j, 6.522j)
Prereq: 2.006 or 6.013; 6.021j
G (Spring)
4-2-6
See description under subject 6.522j.
R. G. Mark

20.472j Neuroimaging Cells and Circuits (New)
(Same subject as 9.472j)
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
See description under subject 6.581j.
A. Jasanoff, P. T. So

20.482j Foundations of Algorithms and Computational Techniques in Systems Biology
(Same subject as 6.581j)
Prereq: 6.021j, 6.034, 6.046, 6.336j, 7.91j, 18.417, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 6.581j.
B. Tidor, J. K. White

20.483j Noninvasive Imaging in Biology and Medicine
(Same subject as 9.173j, 22.56j, HST.561j)
Prereq: 18.03, 8.03, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 22.56j.
A. Jasanoff

20.485 Tools for Assessing Biological Function
Prereq: 5.43, 5.07 or 7.05, 5.47 or 5.52
G (Spring)
3-0-9
Contemporary bioorganic chemistry and chemical biology, emphasizing the application of chemical approaches to interrogate biochemical function. Additionally, techniques for quantitative analysis of macromolecular or systems level characteristics such as protein expression, interaction and signaling will be highlighted. Biomarkers and drug effects are discussed combining the chemistry of small molecules and the biology of the cell to identify therapeutic applications in drug discovery. Meets with 5.55 for first half of term.
B. Imperiali, F. White

20.486j Case Studies and Strategies in Drug Discovery and Development
(Same subject as 7.549j, 15.137j, HST.916j)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
The stages in drug discovery and development begin with target identification and end with the submission of preclinical and clinical data to the regulatory authorities. Following identification of a lead compound, there is optimization of structures for pharmaceutical properties, bioavailability, and safety. Subject relies on actual cases of drug development. A major goal is to analyze the cases and determine how the discovery and development process might be influenced by new and future technologies.

20.487j Optical Microscopy and Spectroscopy for Biology and Medicine (New)
(Same subject as 2.715j)
Prereq: Permission of instructor
G (Fall)
3-0-9
See description under subject 2.715j.
P. T. So, C. Sheppard

20.490j Foundations of Computational and Systems Biology
(Same subject as 7.91j)
Subject meets with 7.36, 20.390
Prereq: 7.05 or 5.07; or 7.01x and 1.00 or 1.001 or 6.00 or 6.001; or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 7.91j.
C. Burge, A. Keating

20.901 Special Topics in Toxicology and Environmental Health
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit
Program of study to be arranged by the student and a BE faculty member, leading to the writing of a substantive paper. Minimum of 12 units required.
Staff

20.902 Special Topics in Biological Engineering
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member. Students write a substantive paper. Minimum 12 units required.
Staff

20.903 Special Topics in Biological Engineering
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.904 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.905 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.906 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.907 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.908 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.909 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.910 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.911 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.912 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.913 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.914 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.915 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.916 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.917 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.918 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.919 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff

20.920 Special Topics in Biological Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.
Staff
20.949 Special Topics in Biological Engineering  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Opportunity for individual or group study of biological engineering not otherwise included in the curriculum. To be arranged by the student and a faculty member.  
Staff

20.950 Research Problems in Biological Engineering  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Directed research in the fields of bioengineering and environmental health. Open only to BE students.  
Staff

20.951 Thesis Proposal  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
0-24-0 [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Thesis proposal research and presentation to the thesis committee.  
Staff

20.952 Special Topics in Biological Engineering  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Detailed discussion of selected topics of current interest. Classwork in various areas not covered by regular subjects.  
Staff

20.960 Teaching Experience in Biological Engineering  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
For qualified graduate students interested in teaching. Tutorial, laboratory, or classroom teaching under the supervision of a faculty member. Total enrollment limited by availability of suitable teaching assignments.  
Staff

20.7G Graduate Thesis  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Program of research leading to the writing of an SM or PhD thesis; to be arranged by the student and the MIT faculty advisor.  
Staff

20.UR Undergraduate Research Opportunities  
Prereq: —  
U (Fall, Spring)  
Units arranged [P/D/F]  
Can be repeated for credit  
Laboratory research in the fields of bioengineering or environmental health. May be extended over multiple terms.  
Fall and Spring: S. Manalis, Staff

20.URG Undergraduate Research Opportunities  
Prereq: —  
U (Fall, IAP, Spring, Summer)  
Units arranged  
Can be repeated for credit  
Emphasizes direct and active involvement in laboratory research in bioengineering or environmental health. May be extended over multiple terms.  
Fall and Spring: S. Manalis, Staff
The anthropology subjects described below are grouped within six areas: Introductory, Social Anthropology, Technology in Cultural Context, Areal and Historical Studies, Special Topics, and Advanced Topics. Students are encouraged to take subjects from each of the first four groups for a fuller overview of the field.

**INTRODUCTORY**

**21A.100 Introduction to Anthropology**
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 4
What kinds of wisdom do other ways of life offer our own? How do other perspectives on the world challenge our assumptions about life? These questions are addressed through the four fields of anthropology: biological, cultural, and linguistic anthropology, and archaeology. We examine family and kinship, religion, economics, politics, survival of indigenous groups, and Western influences from an anthropological perspective to gain appreciation for cultural and ethnic diversity.

*J. Howe*

**21A.109 Understanding Culture**
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4
Students are introduced to anthropological fieldwork and the concept of culture from readings, films, and their own research projects in the Boston area. A practice-focused approach to understanding cultural differences and what produces them. Students discover the excitement and challenges of systematically observing human interaction and convincing others of the accuracy of their findings.

*H. Paxson*

**21A.110 Seminar in Anthropological Theory**
Prereq: Major or minor in Anthropology, or permission of instructor
U (Fall)
3-0-9 HASS
Focuses on core issues and approaches in anthropological theory and method. Studies theoretical frameworks for the analysis and integration of material from other subjects in cultural anthropology. Reading and discussion of classics of anthropological theory and contemporary critiques. Students prepare and present analyses of texts.

*J. Howe*

**SOCIAL ANTHROPOLOGY**

**21A.112 Seminar in Ethnography and Fieldwork**
Prereq: Major or minor in Anthropology, or permission of instructor
U (Spring)
3-0-9 HASS
Introduction to ethnographic practices: the study of and communicating about culture. Subject provides instruction and practice in writing, revision of fieldnotes, and a final paper.

*S. Helmreich*

**21A.113J The Supernatural in Music, Literature and Culture (New)**
(Same subject as 21M.013J)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 3, CI-H
See description under subject 21M.013J.

*E. Harris, J. Howe, C. Shadle*

**21A.211 Magic, Witchcraft, and the Spirit World**
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Spiritual, magical, and “occult” aspects of human behavior in anthropological and historical perspective: magic, ritual curing, trance, spirit possession, sorcery, and accusations of witchcraft. Material drawn from traditional non-western societies, medieval and early modern Europe, and colonial and contemporary North America.

*J. Howe*

**21A.212 Myth, Ritual, and Symbolism**
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
How people make sense of their worlds symbolically through myth, ritual, metaphor, and cosmology. The structure of symbols, the natural and social elements they draw on, their social use, and the messages they convey. Students learn to record and analyze myth and ritual.

*J. Howe*

**21A.215 Medical Anthropology**
Prereq: —
U (Fall)
3-0-9 HASS
Examination of how medicine is practiced cross-culturally, with particular emphasis on Western biomedicine. Analysis of medical practice as a cultural system, focusing on the human, as opposed to the biological, side of things. Also, examines how we and people in other cultures think of disease, health, body, and mind.

*J. Jackson*

**21A.216J Dilemmas in Biomedical Ethics: Playing God or Doing Good?**
(Same subject as SP.622J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
An introduction to the cross-cultural study of biomedical ethics. Examines moral foundations of the science and practice of western biomedicine through case studies of abortion, contraception, cloning, organ transplantation and other issues. Evaluates challenges that new medical technologies pose to the practice and availability of medical services around the globe, and to cross-cultural ideas of kinship and personhood. Discusses critiques of the biomedical tradition from anthropological, feminist, legal, religious, and cross-cultural theorists. Enrollment limited.

*E. C. James*
21A.218J Identity and Difference
(Same subject as SP.454J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
Examines several theoretical perspectives on human identity and focuses on processes of creating categories of acceptable and deviant identities; how identities are formed, how behaviors are labelled, and how people enter deviant roles and worlds; and responses to differences and strategies for coping with these responses. Describes how identity and difference are inescapably linked. Enrollment limited.
J. Jackson

21A.219J Law and Society
(Same subject as 11.163J, 17.249J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H
Studies legal reasoning, types of law and legal systems, and relationship of law to social class and social change. Emphasis on the profession and practice of law including legal education, stratification within the bar, and the politics of legal services. Investigation of emerging issues in the relationship between institutions of law and science. Enrollment limited.
S. Silbey

21A.225J Violence, Human Rights, and Justice
(Same subject as SP.621J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS, CI-H
An examination of the problem of mass violence and oppression in the contemporary world, and of the concept of human rights as a defense against such abuse. Explores questions of cultural relativism, race, gender and ethnicity. Examines case studies from war crimes tribunals, truth commissions, anti-terrorist policies and other judicial attempts to redress state-sponsored wrongs. Considers whether the human rights framework effectively promotes the rule of law in modern societies. Students debate moral positions and address ideas of moral relativism. Enrollment limited.
E. C. James

21A.226 Ethnic and National Identity
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
An introduction to the cross-cultural study of ethnic and national identity. Students explore the history of nationalism, focusing on ideologies about the nation-state, and look at the ways gender, religious and racial identities intersect with ethnic and national ones. Ethnic conflict is examined, along with the emergence of social movements based on identity, in particular indigenous rights movements and the ways culture can become highly politicized. Finally, students discuss the effects of globalization, migration, and transnational institutions. Enrollment limited.
J. Jackson

21A.231J Gender, Sexuality, and Society
(Same subject as SP.455J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H
An introduction to the anthropological study of human sexuality, gender constructs, and the sociocultural systems that these are embedded in. Examines current critiques of Western philosophical and psychological traditions, and cross-cultural variability and universals of gender and sexuality. Enrollment limited.
H. Paxson

21A.233J Masculinity in Popular Culture (New)
(Same subject as SP.410J)
Prereq: —
U (Fall)
3-0-9 HASS
Examines how masculinity is represented in popular culture. Using recent approaches from anthropology, sociology, women’s studies, minority discourses and cultural studies, popular culture is examined as a place where our identities, roles, pleasures and power are negotiated in everyday life. Topics may include the history of masculinity, masculinity as deviance, masculinity in consumer culture, and virtual masculinity.
D. Goodman

21A.235 American Dream: Exploring Class in the US
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Americans have historically preferred to think of the US in classless terms, as a land of economic opportunity equally open to all. Yet, social class remains a central fault line in the US. Subject explores the experiences and understandings of class among Americans positioned at different points along the US social spectrum. Considers a variety of classic frameworks for analyzing social class and uses memoirs, novels and ethnographies to gain a sense of how class is experienced in daily life and how it intersects with other forms of social difference such as race and gender.
C. Wolley

21A.240 Race and Science
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Examines one of the most enduring and influential forms of identity and experience in the Americas and Europe, and in particular the ways race and racism have been created, justified, or contested in scientific practice and discourse. Drawing on classical and contemporary readings from Du Bois to Gould to Gilroy, we ask whether the logic of race might be changing in the world of genomics and informatics, and with that changed logic, how we can respond today to new configurations of race, science, technology, and inequality. Considered are the rise of evolutionary racism; debates about eugenics in the early twentieth century; Nazi notions of “racial hygiene”; nation-building projects and race in Latin America; and the movement in modern biology from race to populations to genes and genomes.
S. Helmreich

21A.245J Power: Interpersonal, Organizational and Global Dimensions
(Same subject as 17.045J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Using examples from anthropology and sociology alongside classical and contemporary social theory, subject explores the nature of dominant and subordinate relationships, types of legitimate authority, and practices of resistance. Examines how we are influenced in subtle ways
by the people around us, who makes controlling decisions in the family, how people get ahead at work, and whether democracies, in fact, reflect the will of the people.

S. Silbey

21A.260 Culture, Embodiment, and the Senses
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines historical and cross-cultural debates about the relationship between mind, brain, emotion, and behavior; memory and recall; sensory experience; and illness and healing. Assesses cultural traditions that challenge scientific interpretations of experience arising from western philosophical and physiological models. Explores how experience itself is culturally mediated, interpreted, and elaborated within symbolic, political, and other fields.

E. C. James

21A.265 Food and Culture (New)
Prereq: —
U (Spring)
3-0-9 HASS

Explores cross-cultural issues in food and identity, brought into focus by new attention to connections between what we eat and who we are. Uses anthropological and literary classics as well as recent writing on the politics of food and agriculture. Examines how identities and socialities are built through food production, preparation, and consumption. Considers how people use food to develop a sense of themselves as moral persons through embodying self-control or religious codes, or as a means of preserving the environment, cultural history, or one’s health.

H. Paxson

TECHNOLOGY IN CULTURAL CONTEXT

21A.336 Marketing, Microchips and McDonalds: Debating Globalization
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H

Class debates the meaning of globalization and explores economic, social, and cultural dynamics in various parts of the world. Questions include: have “global” dynamics existed in the past; is the world becoming more homogenous culturally; what is capitalism and how is it changing. Subject addresses issues such as: factory labor in Java; tourism in the Amazon; immigration in France; high-tech workers in the US; the film industry in Bombay, India; and baseball in Japan. Enrollment limited.

C. Walley

21A.337 Documenting Culture
(Subject meets with CMS.917)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Examines how and why people seek to capture life on film. Examines the motives of documentary and ethnographic filmmakers, including curiosity about exotic peoples, concern with documentary as a form of science, and an interest in capturing the truth about cultural life. Students view documentaries about people in the US and abroad, examining the relationship between film images and “reality,” tensions between art and observation, and the ethical relationship between filmmakers and those they film.

C. Walley

21A.338 Gender, Power, and International Development
(Same subject as SP.457J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines some of the root causes of inequality worldwide and the different consequences that poverty, economic transformations, and development policies often have for women and men. Through an exploration of daily life in Africa, Latin America, Asia and Melanesia, students examine the underlying political, economic, social, and gender dynamics that make “development” an ongoing, worldwide problem.

C. Walley

21A.342 Environmental Struggles
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Offers an international perspective on the environment. Using environmental conflict to consider the stakes that groups in various parts of the world have in nature, while also exploring how ecological and social dynamics interact and change over time, subject considers such controversial environmental issues as: nuclear contamination in Eastern Europe; genetic bio-prospecting in Mexico; toxic run-off in the rural US; the Bhopal accident in India; and the impact of population growth in the Third World.

C. Walley

21A.344j Drugs, Politics, and Culture
(Same subject as STS.062J)
Prereq: —
U (Spring)
3-0-9 HASS

Examines the relationship between drugs, politics, and society in cross-cultural perspective; use of mind-altering and habit-forming substances by “traditional societies”; the development of a global trade in sugar, opium, and cocaine with the rise of capitalism; and the use and abuse of alcohol, LSD, and Prozac in the US. Finishes by looking at the war on drugs, shifting attitudes to tobacco, and by evaluating America’s drug laws.

D. Goodman

21A.348 Photography and Truth
(Subject meets with CMS.835)
Prereq: —
U (Spring)
3-0-9 HASS

Photographs in anthropology serve many purposes: as primary data, illustrations of words in a book, documentation for disappearing cultures, evidence of fieldwork, material objects for museum exhibitions, and even works of art. Topics include: the relationships between subject and treatment of image, between art and photography and ethnographic documentation, the role of a museum photograph and its caption, the social practice of “taking pictures” and a case study of photographing women in the Middle East and North Africa.

J. Howe
21A.350J The Anthropology of Computing
(Same subject as SP.484J, STS.086J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Examines computers anthropologically, as highly meaningful tools and artifacts revealing the social and cultural orders that produce them. Classic texts in computer science are read along with works analyzing links between machines and culture. Explores early computer theory and capitalist manufacturing; cybernetics and WWII operations research; artificial intelligence and gendered subjectivity; the hacking aesthetic, commodification, and creation of the personal computer; the growth of the Internet as a military, academic, and commercial project; the politics of identity in cyberspace; and the emergence of “adaptive” and “evolutionary” computation.
S. Helmreich

21A.355J The Anthropology of Biology (New)
(Same subject as STS.060J)
Prereq: —
U (Fall)
3-0-9 HASS
Applies the tools of anthropology to examine biology in the age of genomics, biotechnological enterprise, biodiversity conservation, pharmaceutical bioprospecting, and synthetic biology. Examine such social concerns such as bioterrorism, genetic modification, and cloning. Offers an anthropological inquiry into how the substances and explanations of biology—ecological, organismic, cellular, molecular, genetic, informatic—are changing. Examines such artifacts as cell lines, biodiversity databases, and artificial life models, and using primary sources in biology, social studies of the life sciences, and literary and cinematic materials, asks how we might answer Erwin Schrodinger’s 1944 question, “What Is Life?,” today.
S. Helmreich

21A.360J The Anthropology of Sound (New)
(Same subject as CMS.710J, STS.065J)
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Examines the ways humans experience sound and how perceptions and technologies of sound emerge from cultural, economic, and historical worlds. Consider how the sound/noise boundary has been imagined, created, and modeled across sociocultural and scientific contexts. Learn how environmental, linguistic, and musical sounds are construed cross-culturally as well as the rise of telephony, architectural acoustics, sound recording, and the globalized travel of these technologies. Questions of sound ownership, property, authorship, and copyright in the digital age are also addressed.
S. Helmreich

21A.430J Introduction to Latin American Studies
(Same subject as 17.55J, 21F.084J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4, CI-H
See description under subject 17.55J.
C. Lawson

21A.441 The Conquest of America
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5
The 500-year encounter between native peoples of the Americas and European power and culture. Exploration and conquest. European ideology and fantasies about “savages.” Colonialism, resistance, and adaptation. Missionizing and culture contact. Cases include struggles of Maya, Iroquois, and native New Englanders. Students learn to use primary documents.
J. Howe

21A.453 Anthropology of the Middle East
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS, CI-H
Examines the cultural production of peoples of the Middle East and North Africa. Topics include politics, social organization, gender roles, and the reception and dissemination of sacred narrative. How the West represents the Orient. How power and politics shape culture, narrative, and performance. Also discusses Middle Eastern communities in North America.
Staff

21A.458J The Harem and the Veil: Images and Representations of Gender in the Middle East
(Same subject as SP.450J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H
An introduction to women and gender in the Middle East and North Africa region, as reflected in anthropology, oral history, and literature. Are common themes—e.g., the harem, the desert, the veil—and modes of expression cross-disciplinary? How do readers determine point of view and positionality, ideology and subjectivity, in fictional, autobiographical, and ethnographic texts? Explores how scholarship in women’s studies and gender studies addresses selected issues—such as activism and human rights—central to contemporary Middle East studies.
Staff

21A.460J Medicine, Religion and Politics in Africa and the African Diaspora
(Same subject as SP.620J)
Prereq: —
U (Spring)
3-0-9 HASS
An exploration of colonial and postcolonial clashes between theories of healing and embodiment in the African world and those of western biomedicine. Examines how Afro-Atlantic religious traditions have challenged western conceptions of illness, healing, and the body, and have offered alternative notions of morality, rationality, kinship, gender and sexuality. Analyzes whether contemporary western biomedical interventions reinforce colonial or imperial power in the effort to promote global health in Africa and the African diaspora.
E. C. James

SPECIAL TOPICS

21A.650, 21A.651 Special Topics in Anthropology
Prereq: Any two subjects in Anthropology
U (Fall, Spring)
Units arranged
Can be repeated for credit
Topics in anthropology not included in other subjects. Students electing this subject must secure the approval of the Head of the Anthropology Program. HASS credit for Special Topics subjects awarded only by individual petitions to the Committee on Curricula. Normal maximum is 6 units; to count toward HASS Requirement, 9 units are required. Exceptional 9-unit projects occasionally approved.
Consult Program Head
21A.660–21A.664 Special Seminars in Anthropology
Prereq: —
U (Fall, IAP, Spring)
3-0-9 HASS
Seminar for subjects taught outside the regularly-offered curriculum.
Staff

21A.URG Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Individual participation in an ongoing research project. For students in the Undergraduate Research Opportunities Program.
Consult Anthropology Program Academic Officer

ADVANCED TOPICS

For Doctoral Program in History, Anthropology, and Science, Technology and Society

21A.750J Social Theory and Analysis
(Same subject as STS.250J)
Prereq: —
G (Fall)
3-0-9
M. Fischer

21A.760J Qualitative Research Methods
(Same subject as 15.349J, STS.401J)
Prereq: —
Acad Year 2007–2008: Not offered
G (Spring)
3-0-9
Training in the design and practice of qualitative research. Organized around illustrative texts, class exercises, and student projects. Topics include the process of gaining access to and participating in the social worlds of others; techniques of observation, fieldnote-taking, researcher self-monitoring and reflection; methods of inductive analysis of qualitative data including conceptual coding, grounded theory, and narrative analysis. Discussion of research ethics, the politics of fieldwork, modes of validating researcher accounts, and styles of writing up qualitative field research.
S. Silbey

21A.780J Representing Reality: Theories and Production of Documentary Film and Video
(New)
(Same subject as STS.451J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9
See description under subject STS.451J.
C. Walley, C. Boebel

21A.790J Ethics of Intervention: Anthropological Approaches (New)
(Same subject as 11.238J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
An historical and cross-cultural study of the logics and practices of intervention: the ways that individuals, institutions, and governments identify conditions of need or “states of emergency” within and across borders that require a response. Examines when a response is viewed as obligatory, when is it deemed unnecessary, and by whom; when the intercession is considered fulfilled; and the rationales or assumptions that are employed in assessing interventions. Theories of the state, globalization, and humanitarianism; power, policy, and institutions; gender, race, and ethnicity; and law, ethics, and morality are examined.
E. C. James

21A.800J Environmental Conflict and Social Change
(Same subject as STS.320J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject STS.320J.
C. Walley

21A.810J Social Study of Science and Technology
(Same subject as STS.350J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject STS.350J.
S. Helmreich

21A.820J Ethnography
(Same subject as STS.360J)
Prereq: STS.250J/21A.750J
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject STS.360J.
M. Fischer

21A.860J Methods for Graduate Research in the Social Sciences
(Same subject as STS.380J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject STS.380J.
S. Silbey, A. McCants

21A.998, 21A.999 Advanced Topics in Anthropology
Prereq: —
G (Fall, Spring)
Units arranged
Can be repeated for credit
Special studies or projects at an advanced level with an Anthropology faculty member.
Consult Program Head

For individual research in anthropology, register for 21A.UR or 21A.URG. For Anthropology prethesis tutorial, register for 21A.ThT. For undergraduate thesis, register for 21A.ThU. Descriptions of these subjects can be found in Course 21 under 21.UR, 21.URG, 21.ThT, and 21.ThU.
The subjects listed below include language, literature, and cultural studies subjects given in Chinese, French, German, Italian, Japanese, Spanish, and Studies in International Literatures and Cultures. A variety of literature subjects given in the original language, as well as some given in English, offer HASS Distribution credit.

HASS-D Language Option: Because the Institute regards competence in foreign language as a fundamental value, students may substitute one language subject at level III or IV (i.e., 21F.103, 21F.104, 21F.109, 21F.110, 21F.303, 21F.304, 21F.403, 21F.404, 21F.503, 21F.504, 21F.703, or 21F.704) for one HASS-D subject. The two remaining HASS-Ds may be chosen from any two of the five HASS-D categories. Students selecting this language option may not choose a second distribution subject taught in the same foreign language or literature.

All first and second year foreign language subjects are open to graduate students for credit. For subjects in English Language Studies, see 21F.211–21F.240.

STUDIES IN INTERNATIONAL LITERATURES AND CULTURES

Studies in International Literatures and Cultures make various modes of intercultural discourse available in English. Those subjects that deal with works from more than one nation give students the opportunity to do work in comparative studies. A significant number of subjects also allow students to study works from a single foreign country.

21F.010 Introduction to European and Latin American Fiction
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 1, CI-H
Studies great works of European and Latin American fiction. Attention to a variety of forms including: the picaresque, epistolary, realist, naturalist, and magical realist fiction. Emphasizes ways in which the unique history of each country shaped the imaginative responses of its writers. Authors include Cervantes, Laclos, Goethe, Mann, Dostoevsky, Flaubert, Zola, Unamuno, Wolf, García Márquez, and Allende. Taught in English.
M. Resnick

21F.011 Topics in Indian Popular Culture
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS, CI-H
Can be repeated for credit
Overview of Indian popular culture over the last two decades, through a variety of material such as popular fiction, music, television and Bombay cinema. Explores major themes and their representations in relation to current social and political issues, elements of the formulaic masala movie, music and melodrama, ideas of nostalgia and incumbent change in youth culture, and questions of gender and sexuality in popular fiction. Taught in English. Enrollment limited.
A. Banerjee

21F.019 Communicating Across Cultures
(Subject meets with 21F.021)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
Examines a range of communication styles and techniques resulting from different cultural norms and traditions. Begins with a general theoretical framework and then moves into case studies. Topics include understanding the relationship between communication and culture, differences in verbal and non-verbal communication styles, barriers to intercultural communication, modes of specific cross-cultural communication activities (argumentation, negotiation, conflict resolution) and intercultural adjustment. Case studies explore specific ways of communicating in Asian and European cultures. Graduate students are expected to complete additional assignments. Taught in English. Enrollment limited.
L. Breslow, B. Widdig

21F.021 Communicating Across Cultures
(Subject meets with 21F.019)
Prereq: —
G (Spring)
3-0-9
See description under subject 21F.019.
L. Breslow, B. Widdig

21F.022 International Women’s Voices
(Same subject as SP.461 J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 1, CI-H
Introduces students to a variety of fictional works by contemporary women writers. Subject’s international perspective emphasizes the extent to which each author’s work reflects her distinct cultural heritage and to what extent, if any, we can identify a female voice that transcends national boundaries. A variety of interpretive perspectives, including sociohistorical, psychoanalytic, and feminist criticism is used to examine the texts. Authors include: Mariama Bâ, Isabel Allende, Anita Desai, Maxine Hong Kingston, Toni Morrison, Doris Lessing, Alifa Riyaat, Yang Jiang, Nawal Al-Saadawi, and Sawako Ariyoshi. Taught in English.
I. de Courtivron

21F.023 Women’s Voices: An International Perspective
Prereq: —
G (Spring)
3-0-9
See description under subject 21F.022).
I. de Courtivron

21F.024 The Linguistic Study of Bilingualism
(Same subject as 24.906 J)
Prereq: —
U (Fall)
3-0-9 HASS, CI-H
See description under subject 24.906 J.
S. Flynn


21F.027 Visualizing Cultures
(Same subject as 21H.917J)
(Subject meets with 21F.590, CMS.874)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H
Credit cannot also be received for 21F.590
Examines how visual images shape the identity of peoples and cultures. A prototype digital project looking at American and Japanese graphics depicting the opening of Japan to the outside world in the 1850s is used as a case study to introduce the conceptual and practical issues involved in visualizing cultures. Guest lecturers include professionals engaged in various aspects of collecting, analyzing, and presenting graphic images. Students create and present a project involving visualized cultures. Taught in English. 21F.590 is for students pursuing a minor in Japanese; students complete some assignments in Japanese. Enrollment limited.
S. Miyagawa, J. Dower

21F.029 Topics in Asian American Literature
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Can be repeated for credit
Close study of topics in the history and criticism of Asian American writing, focusing on a specific period or genre, a group of writers, a theme, or a critical or theoretical issue. Taught in English.
E. Teng

21F.030 East Asian Culture: From Zen to Pop
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Examines traditional forms of East Asian culture (including literature, art, performance, food, and religion) as well as contemporary forms of popular culture (film, pop music, karaoke, and manga). Covers China, Japan, Korea, Taiwan, and Hong Kong, with an emphasis on China. Attention given to women's culture. The influence and presence of Asian cultural expressions in the US are also considered. Use made of resources in the Boston area, including the MFA, the Children's Museum, and the Sackler collection at Harvard. Taught in English.
E. Teng

21F.035 Topics in Culture and Globalization
(Subject meets with 21F.037)
Prereq: —
U (Spring)
3-0-9 HASS
Can be repeated for credit
Topic for Spring 2008: Anime, hip-hop, and other global popular culture. The concept of globalization fosters the understanding of the interconnectedness of cultures and societies geographically wide apart such as America, Europe, Asia, and Africa. Scans existing debates and explores how globalization impacts everyday life in the First and Third World; how globalization leads to a common cosmopolitan culture; the emergence of a global youth culture; and religious, social, and political movements that challenge globalization. Students taking the graduate version are expected to complete additional assignments. Taught in English.
I. Condry

21F.036 Advertising and Popular Culture: East Asian Perspectives
(Subject meets with 21F.190, CMS.888)
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Credit cannot also be received for 21F.190
Examines modern advertising culture in East Asia (with a week devoted to India) with an emphasis on post-socialist China. Topics include the rise of transnational advertising agencies in East Asia since the 1980s; advertising and identity formation; the production of brand culture and its impact on youth culture; music marketing; the new paradigm of neo-tribes; media and advertising, and mobile culture and branding. Case studies of famous advertising campaigns for beer and beverage brands, clothing brands, and Internet portal brands. Lab sessions on how to brand your own imaginary product step by step. View award-winning ads presented at the Asia/Pacific Advertising Festivals and Chinese television commercials. Grade credits offered through CMS 888. Taught in English. 21F.190 is for students pursuing a minor in Chinese; students complete assignments in Chinese.
J. Wang

21F.037 Topics in Culture and Globalization
(Subject meets with 21F.035)
Prereq: —
G (Spring)
3-0-6
Can be repeated for credit
See description under subject 21F.035.
I. Condry

21F.039 Japanese Popular Culture
(Subject meets with 21F.591)
Prereq: —
U (Spring)
3-0-9 HASS
Credit cannot also be received for 21F.591
Examines Japanese popular culture as a way of understanding the changing character of media, capitalism, fan communities and cultural differences. Topics include manga (comic books), hip-hop and other popular music in Japan, anime (Japanese animated films) and feature films, sports (sumo, soccer, baseball), and online communication. Emphasis on contemporary popular culture and theories of gender, sexuality, race, and the workings of power in global culture industries. Several films screened outside of regular class meeting times. Taught in English. 21F.591 is for students pursuing a minor in Japanese; students complete some assignments in Japanese.
I. Condry

21F.040 A Passage to India: Introduction to Modern Indian Culture and Society
Prereq: —
U (Spring)
3-0-9 HASS
Introduction to Indian culture through films, short-stories, novels, essays, newspaper articles. Examines some major social and political controversies of contemporary India through discussions centered on India's history, politics and religion. Focuses on issues such as ethnic tension and terrorism, poverty and inequality, caste conflict, the missing women, and the effects of globalization on popular and folk cultures. Particular emphasis on the IT revolution, outsourcing, the new global India and the enormous regional and subcultural differences. Taught in English.
A. Banerjee
21F.041 Traditional Chinese Literature: Poetry, Fiction, and Drama
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Introduction to some of the major genres of traditional Chinese poetry, fiction, and drama. Intended to give students a basic understanding of the central features of traditional Chinese literary genres, as well as to introduce students to the classic works of the Chinese literary tradition. Works read include *Journey to the West*, *Outlaws of the Margin*, *Dream of the Red Chamber*, and some poetry of the major Tang dynasty poets. Literature read in translation. Taught in English.

E. Teng

21F.046 Modern Chinese Fiction and Cinema
Subject meets with 21F.192
Prereq: —
U (Fall)
3-0-9 HASS

Credit cannot also be received for 21F.192

Covers major works of Chinese fiction and film, from mainland China, Taiwan, and Hong Kong. Focuses on modern period, subject examines Chinese intellectuals, writers, and filmmakers have used artistic works to critically explore major issues in modern Chinese culture and society. Literature read in translation. Taught in English. 21F.192 is for students pursuing a minor in Chinese. Enrollment limited. 

J. Wang

21F.050 French Literature in Translation
Same subject as 21L.490
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Reading and analysis of landmark works of French literature, from the neo-classical period through the end of the twentieth century, in English translation. Attention to intellectual and cultural contexts. Writers include Racine, Molière, Baudelaire, Balzac, Proust, Duras, and Tournier. Taught in English.

E. B. Turk

21F.051 Topics in French Film
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
2-2-8 HASS

Can be repeated for credit

Close study of a topic that relates to the art and history of the French cinema and that focuses on a specific director, movement, theme, critical or theoretical issue, analytic approach, etc. Films shown with English subtitles. May be repeated for credit with permission of instructor. Taught in English.

E. B. Turk

21F.052 French Film Classics
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
2-2-8 HASS

History and aesthetics of French cinema from the advent of sound to present-day. Treats films in the context of technical processes, the art of narration, directorial style, role of the scriptwriter, the development of schools and movements, the impact of political events and ideologies, and the relation between French and other national cinemas. Films shown with English subtitles. Taught in English.

E. B. Turk

21F.055 Media in Weimar and Nazi Germany
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
2-2-8 HASS

Debates over national and media identity in Weimar and Nazi Germany. Production and use of media under extreme political and social conditions with a focus on films (such as *Nosferatu, Berlin, M*, and *Triumph des Willens*) and other media. Media approached as both texts and systems. Considers the legacy of the period, in terms of stylistic influence (e.g. film noir), techniques of persuasion, and media’s relationship to social and economic conditions. Taught in English. Enrollment limited.

W. Uricchio
21F.056 Visual Histories: German Cinema 1945 to Present
(Subject meets with 21F.420)
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
2-2-8 HASS, CI-H
Credit cannot also be received for 21F.420
Studies the history, aesthetics, and cultural contexts of German film since the end of World War II. Explores films of New German Cinema by Fassbinder, Wenders, Herzog, and others; and investigates the film tradition of the GDR and the “internationalization” of German cinema since the 1980s. Special thematic focus on the representation of history in film. Films shown with English subtitles. Taught in English. Enrollment limited.
B. Widdig

21F.059 Paradigms of European Thought and Culture
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS-D, Category 2, CI-H
Subject surveys the main currents of European cultural and intellectual history in the modern period. Introduces a set of ideas and arguments that have played a formative role in European culture, and acquaints students with exemplars of critical thought. Readings begin with the Protestant Reformation and move through the French Revolution up to the post-WWII period. Figures to be considered include Luther, Descartes, Kant, Hegel, Rousseau, Smith, Marx, Freud, Beauvoir, and Foucault. Class discussions set these texts into the context of European culture. Topics to be considered are artworks by Goya, David, and Duchamp; the architecture of Schinkel; the music of Bach; and the literature of Goethe. Taught in English.
Staff

21F.064 Introduction to Japanese Culture
(Subject meets with 21F.592)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 4, CI-H
Credit cannot also be received for 21F.592
Examines the major aesthetic, social, and political elements which have shaped modern Japanese culture and society. Readings on contemporary Japan and historical evolution of the culture are coordinated with study of literary, film, and art, along with an analysis of everyday life and leisure activities. Taught in English. 21F.592 is for students pursuing a minor in Japanese; students complete some assignments in Japanese.
I. Condry

21F.065 Japanese Literature and Cinema
(Subject meets with 21F.593)
Prereq: —
U (Fall)
3-0-9 HASS, CI-H
Credit cannot also be received for 21F.593
Examines both cinematic and literary representations of diverse eras and aspects of Japanese culture such as the classical era, the samurai age, wartime Japan and the atomic bombings, social change in the postwar period, and the appropriation of foreign cultural themes, with an emphasis on the modern period. Directors include Akira Kurosawa and Hiroshi Teshigahara. Authors include Kobo Abe and Yukio Mishima. Films shown with subtitles in English. Taught in English. 21F.593 is for students pursuing a minor in Japanese. Enrollment limited.
I. Condry

21F.067 Cultural Performances of Asia
(Same subject as SP.608J)
(Subject meets with 21F.595)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Credit cannot also be received for 21F.595
Examines both traditional and contemporary forms of performance, in a variety of genres, with particular attention to gender issues. Explores the communicative power of performances with attention to the ways performers, media, cultural settings, and audiences interact. Considers ways in which representation of cultural difference is altered through processes of globalization. Performances viewed live when possible, but also relies on video, audio, and online materials. Taught in English. 21F.593 is for students pursuing a minor in Japanese.
I. Condry

21F.084 Introduction to Latin American Studies
(Same subject as 17.55J)
(Subject meets with 21A.430J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4, CI-H
Credit cannot also be received for 21F.594
See description under subject 17.55J.
C. Lawson

21F.098 Working in a Global Economy
(Same subject as 17.199J)
Prereq: Permission of instructor
U (Fall)
3-0-9 HASS, CI-H
See description under subject 17.199J.
S. Berger, S. Sferza

21F.099 Independent International Research Project
(Same subject as 17.921J)
Prereq: Permission of instructor
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
See description under subject 17.921J.
S. Berger, B. Widdig

CHINESE

Chinese language subjects are divided into ‘regular’ and ‘streamlined’. Typically, streamlined subjects are for students who have some conversational ability from growing up in a Chinese speaking environment, but who have very little writing or reading ability. Students with a strong background in regional languages such as Cantonese or Hokkien are also encouraged to take streamlined subjects, but if in doubt, should consult the coordinator of the Chinese program.

21F.101 Chinese I (Regular)
(Subject meets with 21F.151)
Prereq: —
U (Fall, Spring)
4-0-8 HASS
Introduction to modern standard Chinese (Mandarin) with emphasis on developing conversational skills by using fundamental grammatical patterns and vocabulary in functional and culturally suitable contexts. Basic reading and writing are also taught. For graduate credit, see 21F.151.
T. Chen, J. Zhang

21F.102 Chinese II (Regular)
(Subject meets with 21F.152)
Prereq: 21F.101 or permission of instructor
U (Spring)
4-0-8 HASS
Continuation of 21F.101. For full description, see 21F.101. For graduate credit see 21F.152.
T. Chen, J. Zhang
21F.103 Chinese III (Regular)  
Prereq: 21F.102 or permission of instructor  
U (Fall)  
4-0-8 HASS-D Language Option  
Continuing instruction in spoken and written Chinese, with particular emphasis on consolidating basic conversational skills and improving reading confidence and depth. Lab work required.  
T. Chen, M. Liang

21F.104 Chinese IV (Regular)  
Prereq: 21F.103 or permission of instructor  
U (Spring)  
4-0-8 HASS-D Language Option  
Continuation of 21F.103. For full description, see 21F.103.  
J. Zhang, M. Lian

21F.105 Chinese V (Regular): Discovering Chinese Cultures and Societies  
Prereq: 21F.104 or permission of instructor  
U (Fall)  
3-0-9 HASS  
Students develop more sophisticated conversational and reading skills by combining traditional textbook material with their own explorations of Chinese speaking societies, using the human, literary, and electronic resources available at MIT and in the Boston area.  
M. Liang

21F.106 Chinese VI (Regular): Discovering Chinese Cultures and Societies  
Prereq: 21F.105 or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9 HASS  
Continuation of 21F.105. For full description see 21F.106.  
Staff

21F.107 Chinese I (Streamlined)  
(Subject meets with 21F.157)  
Prereq: Placement test and permission of instructor  
U (Fall)  
3-0-9 HASS  
The first term streamlined sequence. Designed for students who have conversational skills (typically gained from growing up in a Chinese speaking environment) without a corresponding level of literacy. For graduate credit see 21F.157.  
J. Zhang, M. Lian

21F.108 Chinese II (Streamlined)  
(Subject meets with 21F.158)  
Prereq: Placement test and permission of instructor  
U (Spring)  
3-0-9 HASS  
The second term streamlined sequence; continuation of 21F.107. The streamlined sequence is designed for students who have conversational skills (typically gained from growing up in a Chinese speaking environment) without a corresponding level of literacy. For graduate credit see 21F.158.  
J. Zhang, M. Lian

21F.109 Chinese III (Streamlined)  
Prereq: Placement test and permission of instructor  
U (Fall)  
3-0-9 HASS-D Language Option  
Intermediate level subject in streamlined sequence. Designed for students who have conversational skills (typically gained from growing up in a Chinese speaking environment) without a corresponding level of literacy. Consolidates conversation skills, improves reading confidence and broadens composition style.  
J. Zhang

21F.110 Chinese IV (Streamlined)  
Prereq: Placement test and permission of instructor  
U (Spring)  
3-0-9 HASS-D Language Option  
Intermediate level subject in streamlined sequence; continuation of 21F.109. Designed for students who have conversational skills (typically gained from growing up in a Chinese speaking environment) without a corresponding level of literacy. Consolidates conversation skills, improves reading confidence and broadens composition style.  
T. Chen

21F.113 Chinese V (Streamlined)  
Prereq: 21F.110 or placement test and permission of instructor  
U (Fall)  
3-0-9 HASS  
Advanced level subject in streamlined sequence. Designed for students who have conversational skills (typically gained from growing up in a Chinese speaking environment) without a corresponding level of literacy. Students conduct their own explorations of modern China using online and print materials, as well as interviews with Chinese in the Boston area.  
Staff

Graduate Language Subjects

21F.151 Chinese I (Regular)  
(Subject meets with 21F.101)  
Prereq: —  
G (Fall, Spring)  
4-0-5  
See description under subject 21F.101.  
T. Chen, J. Zhang

21F.152 Chinese II (Regular)  
(Subject meets with 21F.102)  
Prereq: 21F.151 or permission of instructor  
G (Spring)  
4-0-5  
See description under subject 21F.102.  
T. Chen, J. Zhang

21F.157 Chinese I (Streamlined)  
(Subject meets with 21F.107)  
Prereq: Placement test and permission of instructor  
G (Fall)  
3-0-6  
See description under subject 21F.107.  
J. Zhang, M. Lian

21F.158 Chinese II (Streamlined)  
(Subject meets with 21F.108)  
Prereq: Placement test and permission of instructor  
G (Spring)  
3-0-6  
See description under subject 21F.108.  
J. Zhang, M. Lian

Chinese Language Option Subjects

21F.190 Advertising and Popular Culture: East Asian Perspectives  
(Subject meets with 21F.036, CMS.888)  
Prereq: —  
Acad Year 2007–2008: U (Spring)  
Acad Year 2008–2009: Not offered  
3-0-10 HASS  
Credit cannot also be received for 21F.036  
For students pursuing a minor in Chinese. Students complete assignments in Chinese. See description under subject 21F.036.  
J. Wang
21F.191 Smashing the Iron Rice Bowl: Chinese East Asia
(Subject meets with 21H.560)
Prereq: —
U (Spring)
2-0-8 HASS
Credit cannot also be received for 21H.560
Examines the experiences of ordinary Chinese people as they lived through tumultuous change in the twentieth century. Class discussion focuses on personal memoirs and films. Includes comparisons between the People’s Republic of China, Taiwan, and Hong Kong. 21F.191 is for students pursuing a minor in Chinese; students complete assignments in Chinese.
P. C. Perdue

21F.192 Modern Chinese Fiction and Cinema
(Subject meets with 21F.046)
Prereq: —
U (Fall)
3-0-10 HASS, CI-H
Credit cannot also be received for 21F.046
For students pursuing a minor in Chinese; students complete assignments in Chinese. See description under subject 21F.046. Enrollment limited.
J. Wang

For Chinese Literature and Culture subjects offered in English, see 21F.029, 21F.030, 21F.036, 21F.043J, 21F.044, 21F.046, and 21F.069J.

ENGLISH LANGUAGE STUDIES (ELS)

21F.211 Intermediate Spoken and Written Communication (ELS)
(Subject meets with 21F.212)
Prereq: Placement test and permission of instructor
G (Fall)
3-0-6
Can be repeated for credit
21F.212 Intermediate Spoken and Written Communication (ELS)
(Subject meets with 21F.211)
Prereq: Placement test and permission of instructor
U (Fall)
3-0-6 HASS
Can be repeated for credit
Continued development of skills in oral comprehension, speaking, reading, and writing for intermediate ESL students. Activities, which include language laboratory work, reinforce understanding and lead to an increased ability to communicate.
P. Brennecke

21F.217 Workshop in Strategies for Effective Teaching (ELS)
(Subject meets with 21F.218)
Prereq: —
G (IAP)
1-0-2
21F.218 Workshop in Strategies for Effective Teaching (ELS)
(Subject meets with 21F.217)
Prereq: —
U (IAP)
1-0-2
A mini-module for international teaching assistants. Covers special problems in teaching when English is a second language and the US as a second culture. Videotaping of practice sessions for feedback. Individualized programs to meet different needs. Graduate TAs have priority.
Staff

21F.219 Workshop in Written Expression (ELS)
(Subject meets with 21F.220)
Prereq: Placement test and permission of instructor
G (Fall, Spring)
3-0-6
Can be repeated for credit
21F.220 Workshop in Written Expression (ELS)
(Subject meets with 21F.219)
Prereq: Placement test and permission of instructor
U (Fall, Spring)
3-0-6
Can be repeated for credit
Writing module for high intermediate ESL students who wish to review and practice accurate grammar, effective sentence and paragraph structure, punctuation, and word choice. Short weekly writing assignments with extensive editing required.
Staff

21F.222 Expository Writing for Bilingual Students
Prereq: Placement test and permission of instructor
U (Fall, Spring)
3-0-9 HASS, CI-H
Can be repeated for credit
Formulating, organizing, and presenting ideas clearly in writing. Reviews basic principles of rhetoric. Focuses on development of a topic, thesis, choice of appropriate vocabulary, and sentence structure to achieve purpose. Develops idiomatic prose style. Gives attention to grammar and vocabulary usage. Special focus on strengthening skills of bilingual students. Undergraduates only. Enrollment limited.
Fall: P. Brennecke
Spring: Staff

21F.223 Listening, Speaking and Pronunciation (ELS)
(Subject meets with 21F.224)
Prereq: Placement test and permission of instructor
U (Fall, Spring)
3-0-6
Can be repeated for credit
21F.224 Listening, Speaking and Pronunciation (ELS)
(Subject meets with 21F.223)
Prereq: Placement test and permission of instructor
G (Fall, Spring)
3-0-6
Can be repeated for credit
Designed for high intermediate ESL students who need to develop better listening comprehension and oral skills. The workshop involves short speaking and listening assignments with extensive exercises in accurate comprehension, pronunciation, stress and intonation, and expression of ideas.
P. Brennecke

21F.225 Advanced Workshop in Writing for Science and Engineering (ELS)
(Subject meets with 21F.226)
Prereq: Placement test and permission of instructor
G (Fall, Spring)
3-0-9
Can be repeated for credit
21F.226 Advanced Workshop in Writing for Science and Engineering (ELS)
(Subject meets with 21F.225)
Prereq: Placement test and permission of instructor
U (Fall, Spring)
3-0-9 HASS, CI-H
Can be repeated for credit
Analysis and practice of various forms of scientific and technical writing, from memos to journal articles. Strategies for conveying technical information to specialist and non-specialist audiences. Comparable to 21W.780 but methods designed to deal with special problems of advanced ESL or bilingual students. The goal of the workshop is to develop effective writing skills for academic and professional contexts. Models, materials, topics and assignments vary from term to term. No listeners. Enrollment limited.
J. Dunphy
21F.227 Advanced Workshop in Writing for Social Sciences and Architecture (ELS)  
(Subject meets with 21F.228)  
Prereq: Placement test and permission of instructor  
G (Spring)  
3-0-9  
Can be repeated for credit

21F.228 Advanced Workshop in Writing for Social Sciences and Architecture (ELS)  
(Subject meets with 21F.227)  
Prereq: Placement test and permission of instructor  
U (Spring)  
3-0-9 HASS, CI-H  
Can be repeated for credit

Focuses on techniques, format, and prose used in academic and professional life. Emphasis on writing required in fields such as economics, political science and architecture. Short assignments include: business letters, memos and proposals that lead toward a written term project. Methods designed to accommodate those whose first language is not English. The goal of the workshop is to develop effective writing skills for academic and professional contexts. Models, materials, topics and assignments vary from term to term. No listeners. Enrollment limited.  
P. Brennecke

21F.232 Advanced Speaking and Critical Listening Skills (ELS)  
(Subject meets with 21F.233)  
Prereq: Placement test and permission of instructor  
G (Fall, Spring)  
3-3-3  
Can be repeated for credit

21F.233 Advanced Speaking and Critical Listening Skills (ELS)  
(Subject meets with 21F.232)  
Prereq: Placement test and permission of instructor  
U (Fall, Spring)  
3-3-3 HASS  
Can be repeated for credit

For advanced students who wish to build confidence and skills in spoken English. Focuses on the appropriate oral presentation of material in a variety of professional contexts: group discussions, classroom explanations and interactions, and theses/research proposals. Valuable for those who intend to teach or lecture in English. Includes language laboratory assignments. The goal of the workshop is to develop effective speaking and listening skills for academic and professional contexts. Models, materials, topics and assignments vary from term to term. No listeners.  
J. Dunphy

FRENCH

All subjects listed below are taught in French. The indication of prerequisites for specific French offerings does not apply to students who have already accomplished the equivalent work. For further placement advice, consult one of the field advisors in French.

Fundamental Language Subjects

21F.301 French I  
(Subject meets with 21F.351)  
Prereq: —  
U (Fall, IAP, Spring)  
4-0-8 HASS

Introduction to the French language and culture with emphasis on the acquisition of vocabulary and grammatical concepts through active communication. Conducted entirely in French. Exposure to the language via a variety of authentic sources such as the Internet, audio, video and printed materials which help develop cultural awareness as well as linguistic proficiency. Coordinated language lab program. For graduate credit see 21F.351.  
L. Revzani

21F.302 French II  
(Subject meets with 21F.352)  
Prereq: 21F.301  
U (Fall, Spring)  
4-0-8 HASS

Continuation of introductory course to the French language and culture with emphasis on acquisition of vocabulary and grammatical concepts through active communication. Conducted entirely in French. Exposure to the language via a variety of authentic sources such as the Internet, audio, video and printed materials which help develop cultural awareness as well as linguistic proficiency. Coordinated language lab. For graduate credit see 21F.352.  
C. Culot

21F.303 French III  
Prereq: 21F.302  
U (Fall, Spring)  
4-0-8 HASS

Review and expansion of French grammar and vocabulary. Continued development of speaking, reading, and writing skills through a web-based exchange with French students. French and MIT students share a common website to compare a variety of materials and exchange viewpoints, with the goal of better understanding each other’s cultures.  
G. Furstenberg

21F.304 French IV  
Prereq: 21F.303  
U (Fall, Spring)  
4-0-8 HASS-D Language Option

Contemporary France in relation to the Franco-phone world. Current materials ranging from literary texts, films, digitized video interviews, the Internet and CD-ROMs. Further development of linguistic skills, for improving the overall quality of writing and oral fluency. Final subject in the French language sequence before taking intermediate subjects in French literature and culture.  
J. Sadock

21F.306 French: Communication Intensive I  
Prereq: Permission of instructor  
U (Fall, Spring)  
3-0-0

21F.307 French: Communication Intensive II  
Prereq: Permission of instructor  
U (Fall, Spring)  
3-0-0

Staff
Intermediate Subjects in Language, Literature, and Culture

These subjects (21F.308–21F.315) are designed for students who have completed French IV or its equivalent. They serve as a transition between language study and more advanced subjects in literature and cultures. Although each subject has a different emphasis, all provide students with additional practice in reading, speaking, writing.

Students may take several subjects from these offerings. Native speakers of French who have studied French literature at a high school level must seek the instructor's approval for admission to any of these subjects.

21F.308 Writing (Like the) French
Prereq: 21F.304
U (Spring)
3-0-9 HASS

For students who wish to continue with language study before taking upper-level subjects in literature or culture. Development of reading and writing skills. Review of the basic concepts of French grammar. Acquisition of precise vocabulary through the use of documents, stories and poems. Taught in French.

C. Culot

21F.310 French Conversation: Intensive Practice
Prereq: 21F.304
U (Fall)
3-0-9 HASS

Contemporary cultural phenomena and political debates in France and the Francophone world. Training in oral expression including communication skills, fluency, idiomatic French and pronunciation. Discussion materials include short literary and sociological texts, recent films, varied audio and digitized video interviews and the Internet. Taught in French. Enrollment limited to 16.

J. Sadock

21F.311 Introduction to French Culture
Prereq: 21F.304
U (Fall)
3-0-9 HASS-D, Category 1

Examines major social and political trends, events, debates and personalities which help place various aspects of contemporary French culture in their historical perspective. Topics include the heritage of the French Revolution, the growth and consequences of colonialism, the role of intellectuals in public debates, the impact of the Occupation, the modernization of the economy and of social structures. Also studied are the sources and meanings of national symbols, monuments, myths and manifestoes. Documents include fiction, films, essays, newspaper articles, and television shows. Recommended for students planning to study abroad. Taught in French.

I. de Courtivron

21F.315 Cross-cultural Perspectives on Contemporary French Society
Prereq: 21F.304
U (Spring)
3-0-9 HASS

Intermediate subject designed to help students gradually build an in-depth understanding of France. Focuses on French attitudes and values regarding education, work, family, and institutions. Deals with the differing notions that underlie interpersonal interactions and communication styles, such as politeness, friendship, and formality. Using a web comparative, cross-cultural approach, students explore a variety of French and American materials and then analyze and compare using questionnaires, opinion polls, news reports (in different media), as well as a variety of historical, anthropological and literary texts. Students involved in team research projects. Attention given to the development of relevant linguistic skills. Recommended for students planning to study and work in France. Taught in French.

Staff

Advanced Subjects in Literature and Culture

Students are required to take at least one intermediate subject before enrolling in advanced subjects. Otherwise they must obtain permission of the instructor.

21F.341 Contemporary French Film and Social Issues
Prereq: 21F.304
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
2-2-8 HASS

Issues in contemporary French society as expressed through movies made in the 1990s. Topics include France's national self-image, the women's movement, sexuality and gender, family life and class structure, post-colonialism and immigration, and American cultural imperialism. Films by Lelouch, Audiard, Doillon, Denis, Klapisch, Resnais, Rouan, Balasko, Collard, Dridi, Kassovitz, and others. Readings from French periodicals. Films shown with English subtitles. Taught in French.

I. de Courtivron

21F.345 Contemporary French Theater: Traditions and New Trends
Prereq: 21F.304
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

A study of major plays of the past six decades, with emphasis on recent works and trends. Attention to the influence of the Theater of the Absurd, the political events of 1968, the intellectual avant-garde, and mass-audience entertainment. Dramatists include Ionesco, Beckett, Genet, Arrabal, Sarrut, Cixous, Duras, Koltès, Reza, Visniec, Ndiaye, Schmitt, Grumberg, Balasko. Taught in French.

E. B. Turk

21F.346 Topics in Modern French Literature and Culture
(Subject meets with SP.466)
Prereq: One intermediate subject in French
U (Fall, Spring)
3-0-9 HASS

Can be repeated for credit

Topic for Spring 2008: Contemporary French and Francophone Playwrights. Close study of history and criticism of French literature, focusing on a specific group of writers, a movement, a theme, a critical or theoretical issue, or an analytic approach. May be repeated for credit with permission of instructor. Offered Spring 2008, Fall 2008, and Spring 2009. Taught in French.

E. B. Turk

21F.347 Contemporary Short French Fiction: Social and Literary Trends since 1980
Prereq: Permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Examines short stories and short novels published in France since 1980. Texts are related to the dominant social and cultural trends of the past two decades. Themes include the legacy of France’s colonial experience, the re-examination of its wartime past, memory and the Holocaust, the specter of AIDS, changing gender relationships, the quest for personal identity, and immigration narratives. Authors include Hélène Cixous, Hervé Guibert, Patrick Modiano, Émilie Nothomb, Annie Ernaux, Christine Angot, Nina Bouraoui, Pierre Michon, Lydie Salvayre, and Jean-Marie le Clezio. Taught in French.

I. de Courtivron
Graduate Language Subjects

21F.351 French I
(Subject meets with 21F.301)
Prereq: —
G (Fall, IAP, Spring)
4-0-5
See description under subject 21F.301.
L. Rezvani

21F.352 French II
(Subject meets with 21F.302)
Prereq: 21F.351
G (Fall, Spring)
4-0-5
See description under subject 21F.302.
C. Culot

For French Literature and Culture subjects offered in English, see 21F.050, 21F.051 and 21F.052.

GERMAN

All subjects listed below are taught in German.
The indication of prerequisites for specific German offerings does not apply to students who have already accomplished the equivalent work. For further placement advice, consult one of the field advisors in German.

Fundamental Language Subjects

21F.400 German I (Study Abroad)
(Subject meets with 21F.450)
Prereq: —
U (IAP)
4-0-8 HASS
Credit cannot also be received for 21F.400, 21F.450, 21F.451

Introduction to German language and culture. Class conducted in Germany with MIT instructors. Acquisition of vocabulary and grammatical concepts through active communication. Audio, video, and printed materials provide direct exposure to authentic German language and culture. Self-paced language lab program is fully coordinated with textbook/workbook. Development of effective basic communication skills. For graduate credit see 21F.451.
D. Jaeger

21F.401 German I
(Subject meets with 21F.451)
Prereq: —
U (Fall, IAP, Spring)
4-0-8 HASS
Credit cannot also be received for 21F.400, 21F.450, 21F.451

Introduction to German language and culture. Acquisition of vocabulary and grammatical concepts through active communication. Audio, video, and printed materials provide direct exposure to authentic German language and culture. Self-paced language lab program is fully coordinated with textbook/workbook. Development of effective basic communication skills. For graduate credit see 21F.451.
D. Jaeger

21F.402 German II
(Subject meets with 21F.452)
Prereq: 21F.401
U (Fall, Spring)
4-0-8 HASS

Expansion of basic communication skills and further development of linguistic competency. Review and completion of basic grammar, building of vocabulary, and practice in writing short essays. Reading of short literary texts. Exposure to history and culture of German-speaking countries through audio, video, and web materials. For graduate credit see 21F.452.
E. Crocker

21F.403 German III
Prereq: 21F.402
U (Fall, Spring)
4-0-8 HASS-D Language Option

Expands skills in speaking, reading, listening, and writing. Develops analytic and interpretative skills through the reading of a full-length drama as well as short prose and poetry (Dürrenmatt, Böl, Borchert, and others) and through media selections on contemporary issues in German-speaking cultures. Discussions and compositions based on these texts. Review of grammar and development of vocabulary-building strategies. Recommended for students with two years of high-school German.
D. Jaeger

21F.404 German IV
Prereq: 21F.403
U (Fall, Spring)
4-0-8 HASS-D Language Option

Development of interpretive skills, using literary texts (B. Brecht, S. Zweig) and contemporary media texts (film, TV broadcasts, web materials). Discussion and exploration of cultural topics in their current social, political, and historical context via hypermedia documentaries. Further refinement of oral and written expression and expansion of communicative competence in practical everyday situations.
E. Crocker

21F.405 Germany Today: Intensive Study of German Language and Culture
Prereq: 21F.403 or 21F.404
U (IAP)
4-0-8 HASS

Prepares students for working and living in German-speaking countries. Focus on current political, social, and cultural issues, using newspapers, journals, TV, radio broadcasts, and web sources from Germany, Austria, and Switzerland. Emphasis on speaking, writing, and reading skills for professional contexts. Activities include: oral presentations, group discussions, guest lectures, and interviews with German speakers. No listeners.
E. Crocker

21F.406 German: Communication Intensive I
Prereq: Permission of instructor
U (Fall, Spring)
3-0-0

21F.407 German: Communication Intensive II
Prereq: Permission of instructor
U (Fall, Spring)
3-0-0

D. Jaeger

Intermediate Subjects in Language, Literature, and Culture

21F.409 Opening the Text: Reading, Writing and Performing in German
Prereq: 21F.403
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Refinement of language skills via the production of own texts. Analysis of students’ manuscripts, the close reading of short literary texts from the 20th and 21st centuries, and interpretative
Advanced Subjects in Language, Literature, and Culture

21F.414 German Culture, Media, and Society
Prereq: 21F.404
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Can be repeated for credit

Investigates current trends and topics in German literary, theater, film, television, radio, and other media arts productions. Analyze media texts in the context of their production, reception, and distribution as well as the public debates initiated by these works. Each semester focuses on a different broader theme. Students have the opportunity to discuss topics with a writer, filmmaker, and/or media artist from Germany. Taught in German.

K. Fendt

21F.415 Germany and its European Context
Prereq: 21F.404
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Can be repeated for credit

Examines the historical, political, and sociological forces that shape present-day Germany. Topics vary and may include: value changes in postwar society, coping with the legacy of the past, multiculturalism in Germany, change of gender roles, cultural differences between East and West after the unification, the role of environmentalism, the process of European integration, and Germany and its neighbors. Draws on current articles, texts and videos from newspapers, journals, the web, and German TV. Integrates and contextualizes the first-hand experiences of German society. Taught in German.

Staff

21F.416 Twentieth & Twenty-First Century German Literature
Prereq: 21F.404
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Can be repeated for credit

Introduces students to important 20th and 21st century literary texts and connects them to the often dramatic course of German history in the last century. Surveys German literature from the beginning of the 20th century to the most recent post-unification texts. Each semester focuses on a different broader theme. Focus for Spring 2008 is “Umbrüche,” the literary reflection of major political and societal shifts that have shaped Germany’s history in the 20th century. Discussions cover dramas, short stories, and novels by authors such as Robert Musil, Botho Strauss, and W. G. Sebald. May be repeated for credit with permission of instructor. Taught in German.

K. Fendt

21F.420 Visual Histories: German Cinema 1945 to Present
(Subject meets with 21F.056)
Prereq: 21F.404 or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
2-2-8 HASS
Credit cannot also be received for 21F.056

Studies the history, aesthetics, and cultural contexts of German film since the end of World War II. Explores films of “New German Cinema” by Fassbinder, Wenders, Herzog, and others, and investigates the film tradition of East Germany and the internationalization of German cinema since the 1980s. Special thematic focus on the representation of history in film. Films shown with English subtitles. One discussion section per week conducted entirely in German; all writing done in German, readings in both German and English.

B. Widdig

Graduate Language Subjects

21F.450 German I (Study Abroad)
(Subject meets with 21F.400)
Prereq: —
G (IAP)
4-0-5
Credit cannot also be received for 21F.400,
21F.401, 21F.451

Introduction to German grammar and culture. Class conducted in German with MIT instructors. Acquisition of vocabulary and grammatical concepts through active communication. Audio, video, and printed materials provide direct exposure to authentic German language and culture. Self-paced language lab program is fully coordinated with textbook/workbook. Development of effective basic communication skills. Students responsible for travel and lodging fees. Field trips introduce students to Germany as a site of science and technology, culture and history. Same as 21F.400, but for graduate credit. Credit cannot also be received for 21F.451. Limited enrollment. Lotteried subject.

D. Jaeger

D. Jaeger

2007–2008

FOREIGN LANGUAGES AND LITERATURES

subjects 21F.351 to 21F.450
21F.451 German I
(Subject meets with 21F.401)
Prereq: —
G (Fall, IAP, Spring)
4-0-5
Credit cannot also be received for 21F.400,
21F.401, 21F.450
See description under subject 21F.401.
D. Jaeger

21F.452 German II
(Subject meets with 21F.402)
Prereq: 21F.451
G (Fall, Spring)
4-0-5
See description under subject 21F.402.
E. Crocker

For German Literature and Culture subjects offered in English, see 21F.055, 21F.056, 21F.059,
21F.061, and 21F.062.

Japanese Language Option Subjects

21F.590 Visualizing Cultures
(Subject meets with 21F.027), 21H.917),
CMS.874)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-10 HASS, CI-H
Credit cannot also be received for 21F.027
Examines how visual images shape the identity
of peoples and cultures. Uses a prototype digital
project looking at American and Japanese
graphics depicting the opening of Japan to the outside
world in the 1850s to introduce the conceptual
and practical issues involved in “visualizing
cultures.” Guest lecturers include professionals
S. Miyagawa, J. Dower

21F.591 Japanese Popular Culture
(Subject meets with 21F.039)
Prereq: —
U (Spring)
3-0-10 HASS
Credit cannot also be received for 21F.039
Examines Japanese popular culture as a way of understanding the changing character of media, capitalism, fan communities and cultural differences. Topics include manga (comic books), hip-hop and other popular music in Japan, anime (Japanese animated films) and feature films, sports (sumo, soccer, baseball), and online communication. Emphasis on contemporary popular culture and theories of gender, sexuality, race, and the workings of power in global culture industries. Several films screened outside of regular class meeting times. Taught in English. Students complete some assignments in Japanese. Students not pursuing a minor in Japanese should register for 21F.039. 
I. Condry

21F.592 Introduction to Japanese Culture
(Subject meets with 21F.064)
Prereq: —
U (Fall)
3-0-10 HASS-D, Category 4, CI-H
Credit cannot also be received for 21F.064
Examines the major aesthetic, social, and political elements which have shaped modern Japanese culture and society. Readings on contemporary Japan and historical evolution of the culture. Study of literary texts, film, and art, along with the analysis of everyday life and leisure activities. Taught in English. Students complete some assignments in Japanese. Students not pursuing a minor in Japanese should register for 21F.064. 
I. Condry

21F.593 Japanese Literature and Cinema
(Subject meets with 21F.065)
Prereq: —
U (Fall)
3-0-10 HASS, CI-H
Credit cannot also be received for 21F.065
Surveys both cinematic and literary representations of diverse eras and aspects of Japanese culture such as the classical era, the samurai age, wartime Japan and the atomic bombings, social change in the postwar period, and the appropriation of foreign cultural themes, with emphasis on the modern period. Directors include Akira Kurosawa and Hiroshi Teshigahara. Authors include Kobo Abe and Yukio Mishima. Films shown with subtitles in English. Taught in English. Students complete some assignments in Japanese. Students not pursuing a minor in Japanese should register for 21F.065. 
I. Condry

21F.595 Cultural Performances of Asia
(Subject meets with SP.608J, 21F.067J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-10 HASS
Credit cannot also be received for 21F.067
Examines both traditional and contemporary forms of performance, in a variety of genres, with particular attention to gender issues. Explores the communicative power of performances with attention to the ways performers, media, cultural settings, and audiences interact. Considers ways representation of cultural difference is altered through processes of globalization. Performances viewed live when possible, but also relies on video, audio, and online materials. Taught in English. Students complete some assignments in Japanese. Students not pursuing a minor in Japanese should register for 21F.067. 
I. Condry

For Japanese Literature and Culture subjects offered in English, see 21F.027J, 21F.039, 21F.064, 21F.065, and 21F.067J.

ITALIAN

All subjects listed below are taught in Italian. The indication of prerequisites for specific Italian offerings does not apply to students who have already accomplished the equivalent work. For further placement advice, consult one of the field advisors in Italian.

Fundamental Language Subjects

21F.701 Spanish I
(Subject meets with 21F.751)
Prereq: —
U (Fall, IAP, Spring)
4-0-8 HASS
Introduction to understanding, speaking, reading, and writing Spanish. Maximal use of fundamentals of grammar in active communication. Audio- and video-based language laboratory program coordinated with and supplemented to class work. For graduate credit see 21F.751. 
Fall: M. Ribas Groeger, Staff 
Spring: Staff

21F.702 Spanish II
(Subject meets with 21F.752)
Prereq: 21F.701
U (Fall, Spring)
4-0-8 HASS
Credit cannot also be received for 21F.782
Introductory subject that continues the study of Spanish language and culture using audio, video and print materials, feature films and popular music from Latin America and Spain. It emphasizes writing, vocabulary acquisition, and the study of more complex grammatical structures. Group interaction and short oral presentations develop students’ oral skills. For graduate credit see 21F.752. 
Fall: R. Gessa 
Spring: S. Marquez, Staff

Fundamental Language Subjects

21F.601 Italian I
(Subject meets with 21F.651)
Prereq: —
U (IAP)
4-0-8 HASS
Focus on basic oral expression, listening comprehension, and elementary reading and writing. Emphasis on the acquisition of vocabulary and grammatical concepts through active communication. Designed for students with no knowledge of Italian. Audio, video, and printed materials provide direct exposure to authentic Italian language and culture. 
Staff

21F.651 Italian I
(Subject meets with 21F.601)
Prereq: —
G (IAP)
4-0-5
See description under subject 21F.601. 
Staff

SPANISH

All subjects listed below are taught in Spanish. The indication of prerequisites for specific Spanish offerings does not apply to students who have already accomplished the equivalent work. For further placement advice, consult one of the field advisors in Spanish.

Fundamental Language Subjects
Intermediate Subjects in Language, Literature, and Culture

These subjects (21F.711–21F.714) are designed for students who have completed Spanish IV or its equivalent. They serve as a transition between language study and more advanced subjects in literature and culture. Although each subject has a different emphasis, all provide students with additional practice in reading, speaking, and writing.

It is required that all students take one of the intermediate-level subjects before enrolling in 21F.716 and above. Students may take several subjects from these offerings. Native speakers of Spanish who have studied Hispanic literature at a high school level must seek the instructor’s approval for admission to any of these subjects.

21F.711 Advanced Spanish Conversation and
Composition: Perspectives on Technology and
Culture
Prereq: 21F.704 or permission of instructor
U (Spring)
3-0-9 HASS

Subject designed as a logical complement to Advanced Reading and Writing in Spanish. Unlike 21F.713, which focuses primarily on literary language, subject focuses on expository and journalistic writing that examines the social and cultural impact of science and technology in Hispanic societies. Topics considered are: family structure and community, personal identity, gender relations, relationship to natural world, value systems and religion, education and work-life. Ethical implications of technological decision-making also discussed. Improves oral and written skills through discussions of audiovisual materials, simulations, interviews, guided compositions, regular journal writing, and participation on an online forum. Readings include: journalistic reports, essays, and literary selections offering diverse perspectives. Taught in Spanish.

M. Ribas Groeger

Advanced Subjects in Literature and Culture

It is strongly advised that all students take one of the intermediate-level subjects before enrolling in an advanced subject. Otherwise students are required to obtain permission of the instructor of the advanced subject.

21F.716 Introduction to Contemporary Hispanic
Literature
Prereq: One intermediate subject in Spanish or permission of instructor
U (Fall)
3-0-9 HASS-D, Category 1

Studies important 20th-century texts from Spain and Latin America that represent the fictional genres: poetry, theater, short story, and the novel. Includes works by Bombal, Lorca, Neruda, Vallejo, Machado, and García Márquez. Taught in Spanish.

E. Garrels

21F.704 Spanish IV
Prereq: 21F.703
U (Fall, Spring)
4-0-8 HASS-D Language Option

Continued study of the language, literature, and culture of Spanish-speaking countries to improve oral and written communication. Materials include contemporary Spanish and Latin American films, literary texts (short stories, poetry and a novel), online video interviews with a variety of Spanish-speakers and other web resources.

M. Ribas Groeger, S. Marquez

21F.705 Oral Communication in Spanish
Prereq: 21F.703
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
4-0-8 HASS

Focuses on oral communication supplemented by written work and uses popular media for listening and viewing practice. Projects involve reading, oral presentations, essays, diaries, and classroom interaction. Includes communication skills needed by students in engineering and management for work in Latin America or Spain. Taught in Spanish.

D. Morgenstern

21F.708 Spanish: Communication Intensive I
Prereq: Permission of instructor
U (Fall, Spring)
3-0-0

21F.709 Spanish: Communication Intensive II
Prereq: Permission of instructor
U (Fall, Spring)
3-0-0


Staff

21F.713 Advanced Reading and Writing in
Spanish
Prereq: 21F.704
U (Fall)
3-0-9 HASS

Read and discuss works by authors from diverse quarters of Hispanic culture and consider basic problems of interpretation. Designed to improve a student’s ability to read, discuss, and write about literary texts, and review advanced Spanish grammar. Materials for class discussion and composition include Hispanic novels, novelas, short stories, plays, and poems. Taught in Spanish.

R. Gessa

21F.714 Spanish for Bilingual Students
Prereq: Fluency in a Spanish dialect
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Designed for students of Hispanic descent and raised in the US. Expands oral and written skills through the study of grammar and increased contact with standard Spanish. Studies recent fiction and poetry as well as specific historical, social, economic, and political aspects of Mexican-American, Puerto Rican, Cuban and other Hispanic/Latino cultures. Taught in Spanish.

D. Morgenstern

Advanced Subjects in Literature and Culture

It is strongly advised that all students take one of the intermediate-level subjects before enrolling in an advanced subject. Otherwise students are required to obtain permission of the instructor of the advanced subject.

21F.712 Spanish Conversation and
Composition
Prereq: 21F.704
U (Fall)
3-0-9 HASS

Further development of spoken and written skills to improve fluency and style. Oral reports by participants on individual topics and group web-based and video projects. Analyses of selected literary texts, films and popular music. Taught in Spanish.

D. Morgenstern
21F.717 Introduction to Spanish Culture
Prereq: One intermediate subject in Spanish or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Studies the major social, political, and aesthetic modes which have shaped Spanish civilization. Coordinates the study of literature, film, art, and architecture with the historical evolution of Spain. Readings and discussions focus on such topics as: the coexistence of Christians, Moors, and Jews; Imperial Spain; the First and Second Republics; and the contemporary period as background for the emergence of distinctively Spanish literary and artistic movements. Taught in Spanish.

Staff

21F.730 Twentieth and Twenty-First Century Hispanic American Literature
Prereq: One intermediate subject in Spanish or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

The Spanish-speaking Americas have just experienced a century of magnificent poetry, world-class fiction, utopian and dystopian politics, hope, nightmare, and the tenacious bravery of everyday life. Concentrates on fiction, poetry, memoirs, testimonial, and urban chronicles from different regions and decades. Possible choices include Darío, Neruda, Vallejo, N. Guillén, Cardenal, Dalton, de la Parra, Bombal, Carpenter, Cortázar, Quiroga, Cervantes, Maria de Zayas, Emilia Pardo Bazán, and Ana Lidia Vega. Taught in Spanish.

Staff

21F.736 The Short Story in Spain and Hispanic America
Prereq: One intermediate subject in Spanish or permission of instructor
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Studies the evolution of the short story in Spain and Hispanic America from the sixteenth century to the present. Considers the short story as a genre with unique possibilities for expression. Some seminars students write their own short stories in Spanish. Authors include: Borges, Cortázar, Quiroga, Cervantes, Maria de Zayas, Emilia Pardo Bazán, and Ana Lidia Vega. Taught in Spanish.

E. Garrels

21F.738 Literature and Social Conflict: Perspectives on Modern Spain
Prereq: One intermediate subject in Spanish
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Considers how major literary texts illuminate principal issues in the evolution of modern Spanish society. Emphasizes the treatment of such major questions as the exile of liberals in 1820, the concept of progress, the place of religion, urbanization, rural conservatism and changing sex roles, and the Spanish Civil War. Authors include: Pérez Galdós, Pardo Bazán, Unamuno, Ortega y Gasset, Salinas, Lorca, La Pasionaria, and Falcón. Taught in Spanish.

M. Resnick

21F.739 Globalization and its Discontents: Spanish-speaking Nations (New)
Prereq: 21F.704 or above or permission of instructor
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Designed for students who have lived, worked, studied, or completed internships in Spain or Latin America, who wish to study new paradigms of cultural exchange. Seminar examines how globalization is rapidly changing the identity of peoples and cultures in Spanish-speaking nations. Each student chooses a research project that allows for reflection and writing about the specific aspect of Hispanic culture that has been shaped by contemporary forces in the global economy. Topics examined are wide-ranging and derived from student experience and interest: treating AIDS and tuberculosis in Peru; the Venezuelan/Cuban connection; Latin American immigration in Spain; and “the wall” between US and Mexico. Taught in Spanish except when guest field experts speak. Papers written in Spanish. Readings in Spanish and English.

M. Resnick

21F.740 The New Spain: 1977–Present
Prereq: One intermediate subject in Spanish or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Deals with the vast changes in Spanish social, political, and cultural life that have taken place since the death of Franco. New freedom from censorship; the re-emergence of strong movements for regional autonomy: the Basque region and Catalonia; the new cinema including Almodóvar and Saura; educational reforms instituted by the socialist government, and the fiction of Carme Riera and Terenci Moix. Special emphasis placed on the emergence of mass media as a vehicle for expression in Spain. Consideration given to the changes wrought by Spain’s acceptance into the European Community. Material includes magazines, newspapers, films, fiction and Amando de Miguel’s Los Españoles. Taught in Spanish.

M. Resnick

Graduate Language Subjects

21F.751 Spanish I
(Subject meets with 21F.701)
Prereq: —
G (Fall, IAP, Spring)
4-0-5

See description under subject 21F.701.
Fall: M. Ribas Groeger, Staff
Spring: Staff

21F.752 Spanish II
(Subject meets with 21F.702)
Prereq: 21F.751
G (Fall, Spring)
4-0-5

See description under subject 21F.702.
Fall: R. Gessa
Spring: S. Marquez, Staff

For Spanish Literature and Culture subjects taught in English, see 21F.010 and 21F.084J.
SPECIAL TOPICS

21F.910 Special Topics in Foreign Languages and Literatures
Prereq: —
U (Fall)
Units arranged
Can be repeated for credit

21F.911 Special Topics in Foreign Languages and Literatures
Prereq: —
U (IAP, Spring)
Units arranged
Can be repeated for credit

Advanced work in foreign languages and literatures for students wishing to pursue topics or projects not provided by regular subject offerings. Before registering, student must plan course of study with appropriate instructor in the section and secure the approval of the Section Head. Normal maximum is 6 units; to count toward HASS Requirement, 9 units are required. Exceptional 9-unit projects occasionally approved.

Consult Foreign Languages and Literatures Headquarters

For individual research in foreign languages and literatures, register for 21F.UR or 21F.URG. For foreign languages and literatures pre-thesis tutorial, register for 21F.ThT. For undergraduate thesis, register for 21F.ThU. Descriptions of these subjects can be found in Course 21 under 21.UR, 21.URG, 21.ThT, and 21.ThU.
21H.001 How to Stage a Revolution (New)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5, CI-H
Explores fundamental questions about the causes and nature of revolutions by looking at how people overthrow their rulers and establish new governments. Considers a set of major political transformations throughout the world and across centuries to understand the meaning of revolution and evaluate its impact. Examines how revolutionaries have attempted to establish their ideals and realize their goals. Asks whether radical upheavals require bloodshed, violence, or even terror. Goal is to explain why some revolutions succeed and others fail. Materials include the writings of revolutionaries, declarations and constitutions, music, films, art, novels, memoirs, and newspapers.
W. Broadhead, M. Jacobs, P. C. Perdue

American History

21H.101 American History to 1865
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
A basic history of American social, economic, and political development from the colonial period through the Civil War. Examines the colonial heritages of Spanish and British America; the American Revolution and its impact; the establishment and growth of the new nation; and the Civil War, its background, character, and impact. Readings include writings of the period by Winthrop, Paine, Jefferson, Madison, W. H. Garrison, G. Fitzhugh, H. B. Stowe, and Lincoln.
P. Maier

21H.102 American History since 1865
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5, CI-H
Examines the history of American politics, economics, and society from the Civil War to the present. Use of secondary accounts and primary documents such as court cases, letters and diaries, photographs, and films to examine some of the key issues in the development of modern America: industrialization and urbanization, US emergence as a global power, growth of consumer culture, and the development of the civil rights movement.
C. Capozzola

21H.103 American Indian History From Columbus to the Present (New)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
An introduction to American Indian history since 1492, with an emphasis on its environmental dimensions. Topics include indigenous societies before the arrival of Europeans, epidemics and colonialism, the fur trade, federal Indian policy and the white-Indian wars, life on the reservations, struggles for land and native hunting and fishing rights, American Indian identity in law and popular culture, casinos, and American Indians and environmental politics.
N. Buchanan

21H.104 Riots, Strikes, and Conspiracies in American History
(Same subject as 11.015j)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5, CI-H
Readings and discussions focusing on a series of short-term events that shed light on American politics, culture, and social organization. The events studied in 2006 were the Boston Tea Party of 1773; the crisis at Boston over the case of Anthony Burns, an escaped slave, in 1854; the Homestead strike of 1892; and the student uprisings at Columbia University in 1968. Emphasis is on finding ways to make sense of these complicated, highly traumatic events, and on using them to understand larger processes of change in American history.
R. M. Fogelson

21H.105 American Classics
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS-D, Category 5, CI-H
An examination of classic documents in American history from the 17th through the 20th centuries, including writings by authors such as John Winthrop, Thomas Jefferson, and James Madison; Frederick Douglass, William Lloyd Garrison, and Abraham Lincoln; Horatio Alger, Franklin D. Roosevelt, Betty Friedan, and Martin Luther King, Jr. Possible materials include music, taped speeches, television programs, and motion pictures.
P. Maier

21H.112 The American Revolution
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
English and American backgrounds of the Revolution; issues and arguments in the Anglo-American conflict; colonial resistance and the beginnings of republicanism; the Revolutionary War; constitution writing for the states and nation; and effects of the American Revolution. Concerned primarily with the revolutionary origins of American government. Readings emphasize documents from the period—pamphlets, correspondence, the minutes or resolutions of resistance organizations, constitutional documents and debates.
P. Maier

21H.116 The Civil War and Reconstruction
(Same subject as STS.029j)
(Subject meets with STS.423)
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Anti-slavery and the intensification of sectionalism in the 1850s; the secession crisis; political and military developments in the Civil War years; why the North won; and the political, economic, and social legacies of the conflict.
M. R. Smith

21H.126 America in Depression and War
Prereq: —
U (Spring)
3-0-9 HASS
The Great Depression and World War II permanently changed American politics and society. Topics include: the Great Crash, the New Deal, Roosevelt, the home front, the Normandy Invasion, and the atomic bomb. Explores those
events through film, posters, newspapers, and other historical documents.

M. Jacobs

21H.131 The United States in the Nuclear Age: Politics, Culture, and Society Since 1941
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

American experience at home and abroad from Pearl Harbor to the end of the Cold War. Topics include: America’s role as global superpower, foreign and domestic anticommunism, social movements of left and right, suburbanization, and popular culture.

M. Jacobs

21H.150J Introduction to Asian American Studies: Literature, Culture, and Historical Experience
(Same subject as 21F.043J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

See description under subject 21F.043J.

E. Teng

21H.206 American Consumer Culture
Prereq: —
U (Fall)
2-0-10 HASS

Examines how and why twentieth-century Americans came to define the “good life” through consumption, leisure, and material abundance. Explores how such things as department stores, advertising, mass-produced cars, and suburbs transformed the American economy, society, and politics.

M. Jacobs

21H.221J Migration and Immigration in US History
(Same subject as 11.019J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines the history of the US as a “nation of immigrants” within a broader global context. Considers migration from the mid-19th century to the present through case studies of such places as New York’s Lower East Side, South Texas, Florida, and San Francisco’s Chinatown. Examines the role of memory, media, and popular culture in shaping ideas about migration. Includes optional field trip to New York City.

C. Capozzola

21H.223 War and American Society
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Throughout American history, the experience of war has shaped the ways that Americans think about themselves, their fellow citizens, and the meanings of American citizenship. Examines how Americans have told the stories of modern war in history, literature, and popular culture from the Civil War to the present, and interprets those documents in terms of changing ideas about American identity.

C. Capozzola

21H.224 Constitutional Law in US History
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Introduces major themes and patterns of change in American constitutional law since 1787, including federal-state relations, racial and gender equality, economic regulation, and civil liberties. Readings consist of original court cases, especially from the US Supreme Court, including cases of the current term. Emphasis on the historical development of constitutional law and on the relationship between the Supreme Court and broader social, political, and cultural trends.

C. Capozzola

21H.225J Gender and the Law in US History
(Same subject as SP.607J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Examines women’s role and status in American society, with a focus on the social, political, and cultural consequences of legal decisions, and the ways in which gender, race, and class shape these processes. The course will consider the legal and social history of the women’s movement from 1600 to the present.

C. Capozzola

21H.231J American Urban History I
(Same subject as 11.013J)
Prereq: —
U (Spring)
2-0-7 HASS

See description under subject 11.013J.

R. M. Fogelson

21H.232J American Urban History II
(Same subject as 11.014J)
Prereq: —
U (Fall)
2-0-7 HASS

See description under subject 11.014J.

R. M. Fogelson

21H.234J Downtown
(Same subject as 11.026J)
(Subject meets with 11.339)
Prereq: —
U (Spring)
2-0-7 HASS

Seminar on downtown in US cities from the late 19th century to the late 20th. Emphasis on downtown as an idea, place, and cluster of interests, on the changing character of downtown, and on recent efforts to rebuild it. Considers subways, skyscrapers, highways, urban renewal, and retail centers. Focus on readings, discussions, and individual research projects. Meets with 11.339, but assignments differ.

R. M. Fogelson

EUROPEAN HISTORY

21H.301 The Ancient World: Greece
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5, CI-H

History of Ancient Greece from the Bronze Age to the death of Alexander. Major social, economic, political, and religious trends. Homer, heroism, and the Greek identity; the hoplite revolution and the rise of the city-state; Herodotus, Persia, and the (re)birth of history; Empire, Thucydidean rationalism, and the Peloponnesian War; Aristotle, Macedonia, and Hellenism. Emphasis on use of primary sources in translation.

S. Ostrow

21H.302 The Ancient World: Rome
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5, CI-H

History of Rome from its humble beginnings to the 5th century AD. First half: Kingship to
Republican form; the conquest of Italy; Roman expansion: Pyrrhus, Punic Wars and provinces; classes, courts, and the Roman revolution; Augustus and the formation of empire. Second half: Virgil to the Vandals; major social, economic, political and religious trends at Rome and in the provinces. Emphasis on use of primary sources in translation.

W. Broadhead

21H.306 The Middle Ages: 500–1300
Prereq: —
U (Spring)
3-0-9 HASS
Survey of the history of western Europe, Byzantium, and the Islamic World between 200 and 1500. Topics include the late Roman Empire and the “barbarian” invasions; the emergence of Christianity and the Church; the formation of the Carolingian, Byzantine, and Islamic empires; the Vikings and Mongols; castles, knights, and “feudalism”; medieval warfare and the crusades; religious thinkers, reformers, and heretics; the experience of women and Jews; the rise of cities and trade; the Black Death and the fall of Constantinople.

E. Goldberg

21H.308 The Vikings (New)
Prereq: —
U (Spring)
3-0-9 HASS
Explores the complex relationship of the Vikings with the medieval world, examines developments within Scandinavian society such as state formation, social structures, trade, shipbuilding, slavery, urban growth, and Christianization. Considers the methodological difficulties presented by the diverse and often contradictory historical sources for information about the Vikings, such as monastic chronicles, archaeology, coin hoards, stone inscriptions, and sagas.

E. Goldberg

21H.311 The Renaissance: 1300–1600
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
European history from the 14th through the 16th century. Consideration of political, social, artistic, and scientific developments during this period of transition to the modern world. Examines the connections between Renaissance Humanism and the Protestant and Catholic reform movements of the 16th century. Studies works by Petrarch, Machiavelli, Brunelleschi, Leonardo, Erasmus, More, Luther, and Montaigne.

J. Ravel

21H.342 The Royal Family
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS
An exploration of the changing role of the monarchy in British politics and culture, beginning with the accession of the House of Hanover (later Windsor) in 1714. The dynasty has encountered a series of crises, in which the personal and the political have been inextricably combined: for example, George III’s mental illness; the scandalous behavior of his son, George IV; Victoria’s withdrawal from public life after the death of Prince Albert; the abdication of Edward VIII; and the public antagonism sparked by sympathy for Diana, Princess of Wales. In addition to readings, materials include portraits, news footage, and films.

H. Ritvo

21H.346 France 1660–1815: Enlightenment, Revolution, Napoleon
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS
French politics, culture, and society from Louis XIV to Napoleon Bonaparte. Attention given to the growth of the central state, the beginnings of a modern consumer society, the Enlightenment, the origins and course of the French Revolution, and the rise and fall of Napoleon.

J. Ravel

21H.402 The Making of a Roman Emperor
Prereq: —
U (Fall)
3-0-9 HASS
Through close examination of the emperor Augustus and his Julio-Claudian successors, this subject investigates how Roman emperors used art, architecture, coinage, and other media to create and project an image of themselves, how the surviving literary sources from the Roman period reinforced or subverted that image, and how both phenomena have contributed to post-classical perceptions of Roman emperors. Also considers works of Suetonius and Tacitus, and modern representations of the emperors such as those found in the films I, Claudius and Quo Vadis?.

W. Broadhead

21H.405J The Ancient City
(Same subject as 11.012J)
Prereq: —
U (Spring)
3-0-9 HASS
Historical topography of the Greek and Roman city. Investigates the relationship between urban architecture and the political, social, and economic role of cities in the Greek and Roman world. Analyzes a range of archaeological and literary evidence relevant to the use of space in Greek and Roman cities (Athens, Paestum, Rome, and Pompeii). Subjects of detailed study include the sanctuary of Athena on the Athenian Acropolis, the atrium houses of Roman Pompeii, the Athenian Agora and the Roman Forum, feeding the ancient city, and the great bath complexes of Imperial Rome.

W. Broadhead

21H.411 History of Western Thought, 500–1300
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Examines the development of the western intellectual tradition from the fall of the Roman Empire through the High Middle Ages. Basic premise is that the triumph of Christianity in Europe was not the inevitable outcome it appears from hindsight. Attention is therefore focused not only on the development of Christian thought and practice, but on its challengers as well. Particular emphasis devoted to Nordic paganism, the rise of Islam, Byzantine orthodoxy, indigenous heretical movements, and the ambiguous position of Jews in European society.

A. McCants

21H.416J Medieval Economic History in Comparative Perspective
(Same subject as 14.70J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5
Surveys the conditions of material life and changing social and economic relations in medieval Europe using the comparative context of contemporary Islamic, Chinese, and Japanese experiences. Covers the emergence and decline of feudal institutions, the transformation of peasant agriculture, living standards and the course of epidemic disease, and the ebb and flow of long-distance trade across the Eurasian system. Particular emphasis placed on the study of those factors, both institutional and technological, which contributed to the emergence of capitalist organization and economic growth in...
western Europe in contrast to the trajectories followed by the other major medieval economies.

A. McCants

21H.418 From Print to Digital: Technologies of the Word, 1450–Present
(Subject meets with CMS.880)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Explores the impact of new technology on the recording and distribution of words at three different times: the invention of the printing press ca. 1450; the adaptation of electricity to communication technology in the nineteenth century (telegraph, telephone, phonograph); and the emergence of digital media today. Assignments include essays and online projects.

J. Ravel

21H.421 Introduction to Environmental History
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5, CI-H

Focusing primarily on the period since 1500, explores the influence of climate, topography, plants, animals, and microorganisms on human history and the reciprocal influence of people on the environment. Topics include the European encounter with the Americas, the impact of modern technology, and the historical roots of the current environmental crisis.

H. Ritvo

21H.433 The Age of Reason: Europe from the 17th to the Early 19th Centuries
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5, CI-H

A study of the evolution of European society from the end of the 17th to mid-19th century: its politics, the nature of its social system, the workings of its economy, and its intellectual accomplishments. Particular attention given to the analyses made by critics and contemporary thinkers to the matters treated in the subject, such as Descartes, Spinoza, Voltaire, Locke, Rousseau, Hegel, and Marx.

J. Ravel

21H.441 Revolutionary Europe, 1789–1899
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Examines European history through the lens of one recurrent event—the political and social upheaval of revolution. Explores how ideology and economy combine to force social and political change. Focuses on the French Revolution of 1789, the Paris commune of 1871, the fascist counter-revolutions in Italy and Germany, and the revolt against communism in central Europe in 1989.

D. Ciarlo

21H.443 European Imperialism in the 19th and 20th Centuries
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Explores the history of European imperialism in its political, economic, and cultural dimensions. Examines the role imperialism played in the development of European society and culture in the 19th and 20th centuries, alongside case studies of the experiences of the colonized in Africa, India, and Asia. Topics include: colonial economics in European industrialization; imperial science and the rise of “scientific” racism; the myth of empire in European national identity; class and gender in imperial ideology; “modernization” and cultural transformation in the colonies; decolonization; and globalization in the post-colonial world.

D. Ciarlo

21H.447 Nazi Germany and the Holocaust
Prereq: —
U (Fall)
3-0-9 HASS

German history in the early 20th century, focusing on the rise and fall of Nazism through readings from the time and interpretations by historians. Topics include: the roots of racist thought in Imperial Germany, the impact of the First World War; the flowering of culture in the Weimar Republic and the reaction to it; Nazism as political coup or social movement; the structure of the Nazi state; the experience of the Second World War in Germany and Europe; the origins of the Holocaust; and the memory of Nazism and of the Holocaust in postwar Germany.

D. Ciarlo

21H.466 Imperial and Revolutionary Russia: Culture and Politics
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Analyses Russia’s social, cultural, and political heritage. Compares reforming and revolutionary impulses in the context of serfdom, the rise of the intelligentsia, and debates over capitalism. Focuses on historical and literary texts, especially the intersections between the two.

E. Wood

21H.467 Soviet and Post-Soviet Politics and Society, 1917–Present
(Same subject as 17.57J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4

Explores political and historical evolution of Soviet state and society from 1917 Revolution to its demise in 1991. Subject covers the creation of a revolutionary regime; causes and nature of the Stalin revolution; post-Stalinist efforts to achieve radical political and social reform; and causes of the Soviet collapse. Also examines current developments in Russia in light of Soviet history.

E. Wood

ASIAN HISTORY

21H.504 East Asia in the World: 1500–2000 A.D.
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5, CI-H

Examines the interactions of East Asia with the rest of the world and the relationships of each of the East Asian countries with each other, from ca. 1500 to 2000 AD. Primary focus on China and Japan, with some reference to Korea, Vietnam, and Central Asia. Asks how international diplomatic, commercial, military, religious, and cultural relationships joined with internal processes to direct the development of East Asian societies. Addresses perceptions and misperceptions among East Asians and foreigners.

P. C. Perdue

21H.521 Ancient Japan and the Courtly Society
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Japanese history and culture from earliest times to the late twelfth century. Covers prehistoric cultures, creation myths, native and borrowed beliefs (Shinto, Buddhism, and Confucianism), the origins of the imperial dynasty, and the emergence of a highly aesthetic court society sometimes called “the world of the shining prince.” Readings include many writings in translation (poems, prayers, popular tales, classics by women, etc.). Early art is introduced.

Staff
21H.522 Japan in the Age of the Samurai: History and Film
Prereq: —
U (Fall)
3-0-9 HASS
Medieval Japanese society and culture from the twelfth to the nineteenth centuries, when political power rested largely in the hands of feudal warriors. Topics include religion (especially Zen Buddhism); changing concepts of “the way of the warrior;” women under feudalism; popular culture; and protest and rebellion. Presentations include weekly feature films. Assigned readings include many literary writings in translation.
Park

21H.523 Emergence of the Modern Japanese State, 1800–1952
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5
Interdisciplinary and global perspectives on Japan’s emergence as a powerful modern state. Begins in the period of national seclusion which ended in 1853, then addresses the creation of the Meiji state (1868–1912), Japan’s emergence as an imperialist power, the accomplishments and costs of rapid Westernization and “modernization,” and the road to war and defeat in World War II. Concludes with the postwar US occupation of Japan (1945–1952). Translated materials, graphics, and films help provide both elite and popular Japanese perspectives.
Park

21H.546 World War II in Asia: Film, Fantasy, Fact
Prereq: —
Acad Year 2007–2008: Not offered
U (Spring)
3-0-9 HASS
Propaganda and ideology in World War II, as seen especially through Japanese and American eyes, from the invasion of China in 1937 through the use of the atomic bomb and Japan’s surrender in 1945. This graphic cross-cultural approach raises questions of national and racial stereotyping, and challenges students to assess the role of prejudice, emotion, and irrationality in human behavior. Uses extensive written materials from the Japanese side and a large number of visual materials including classic wartime films from both sides.
J. Dower

21H.560 Smashing the Iron Rice Bowl: Chinese East Asia
(Subject meets with 21F.191)
Prereq: —
U (Spring)
2-0-7 HASS
Credit cannot also be received for 21F.191
Examines the experiences of ordinary Chinese people as they lived through tumultuous change in the 20th century. Class discussion focuses on personal memoirs and films. Includes comparisons between the People’s Republic of China, Taiwan, and Hong Kong.
P. C. Perdue

21H.571 History of Modern South Asia
Prereq: —
U (Fall)
3-0-9 HASS, CI-H
Survey of Indian civilization from 2500 BC to present day. Traces major political events as well as economic, social, ecological, and cultural developments. Primary and secondary readings enhance understanding of this unique civilization, and shape and improve understanding in analyzing and interpreting historical data. Examines major thematic debates in Indian history through class discussion.
H. Roy

21H.573 Religion and Politics in Modern South Asia
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Examines how religion and politics have shaped identities, societies and the historical past in modern South Asia. Explores the growth and dissemination of major South Asian religions including Hinduism, Islam, Buddhism, Jainism and Sikhism in ancient and early modern India. Focuses on formation of religious identities within the politics of nationalism and colonialism. Examines how religion has influenced recent geopolitics of South Asia, with specific focus on India, Pakistan, and Bangladesh.
H. Roy

21H.575 Women in South Asia from 1800 to Present
(Same subject as SP.459J)
Prereq: —
U (Fall)
3-0-9 HASS
Exploration of the changes and continuities in the lives of South Asian women. Using gender as a lens, examine how politics of race, class, caste, and religion have affected women in South Asian countries, primarily in India, Pakistan, Bangladesh and Sri Lanka. Current debates within South Asian women’s history illustrate the issues and problems that arise in re-writing the past from a gendered perspective. Primary documents, secondary readings, films, newspaper articles, and the Internet.
H. Roy

21H.577| Film, Fiction, and History in India, 1905–2005
(Same subject as CMS.882J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Examines how the history of modern India has been recorded and reconstructed in diverse media. Primary documents, films, novels, short stories and secondary documents written by historians serve as tools of analysis to explore the connections between history and popular culture. Themes include Indian nationalism, British imperialism, Partition and Independence, communalism, urban-rural linkages, and the construction of class, caste, and gendered identities.
H. Roy

21H.579 Gandhi’s India (New)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Mohandas K. Gandhi’s iconic status, both in India and abroad, owes much to his leadership role in the struggle for Indian independence from British rule. Gandhi’s philosophy of nonviolence, political morality, and his critique of western modernity were developed in the context of the history of the Indian nationalist movement and are inextricably linked to it. Examines the emergence of Gandhi and his legacy within the context of the anti-colonial nationalist movement in India. Introduction to the tools of the historian’s craft such as interpretation based on critical reading of primary texts and secondary historical analyses.
H. Roy

21H.580 From the Silk Road to the Great Game: China, Russia, and Central Asia, 500–2000 A.D.
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Examines interactions across the Eurasian continent between Russians, Chinese, Mongol-
lian nomads, and Turkic oasis dwellers during the last millennium and a half. As empires rose and fell, religions, trade, and war flowed back and forth continuously across this vast space. Britain and Russia competed for power over Eurasia in the “Great Game” of geopolitics in the 19th century, just as China, Russia, and others did in the 20th century. Today, the fall of the Soviet Union and China’s reforms have opened new opportunities for cultural interaction. Topics include the religious traditions of Central Asian Islam, Buddhism, Christianity, and Confucianism; caravans and travelers like Marco Polo and Rabban Sauma, the first Chinese to travel to the West; and nomadic conquest and imperialist competition, past and present. Source materials include primary documents, travelogues, films, and music from Yo Yo Ma’s Silk Road Project.

**P. C. Perdue**

**MIDDLE EASTERN HISTORY**

21H.601 Islam, the Middle East, and the West
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5

Provides students with an overview of basic themes and issues in Middle Eastern history from the rise of Islam to the present, with an emphasis on exchanges and encounters between the Middle East and Europe/North America. Examines the history of the notion of “East” and “West”; the emergence of Islam and the Christianization of Europe; Ottoman expansion and the flourishing of European powers; European competition with and colonization of Middle Eastern societies, and Middle Eastern responses.

*M. Belli*

21H.615 The Middle East in the Twentieth Century
Prereq: —
U (Spring)
3-0-9 HASS, CI-H

Surveys major political, socioeconomic, and cultural changes in the Middle East after 1900. Investigates the demise of the Ottoman and Qajar dynasties, the rise of new nations and nationalist identities, and the development of modern states and societies. Examines contemporary issues in historical perspective: the Arab-Israeli conflict, the Gulf War, oil and regional security, the impact of the Iranian revolution, and Islamic movements. Heavy emphasis on primary sources, such as novels and historical documents. Enrollment limited.

*M. Belli*

21H.621 Nation, Faith, and Gender in the Modern Middle East
Prereq: —
U (Fall)
3-0-9 HASS

Surveys the development of national, religious, and gendered identities in the Middle East during the 19th and 20th centuries. Examines European imperialism, theories of nationalism, and state formation in the successor states of the Ottoman Empire, as well as Iran. Considers national identities in light of minority, gender, and sectarian issues. Topics include Arab nationalism, Zionism, Palestinian nationalism, and regional case studies.

*M. Belli*

21H.631 Palestine and the Arab-Israeli Conflict
Prereq: —
U (Spring)
3-0-9 HASS

Traces the history of the Arab-Israeli conflict from the 19th century up to the present. Explores the role of ideology, political actors, social history, economic and infrastructural problems, and regional and international interaction, as well as prospects for peace in the 21st century. Examines the related historiographical debates, especially those focusing on the Arab-Israeli Wars of 1948 and 1967.

*M. Belli*

**AFRICAN HISTORY**

21H.705 Introduction to the History of Modern Africa
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Surveys the history of sub-Saharan Africa from c.1880 to the present, and considers African responses to social change. Major themes include European colonialism, African nationalism and nationhood, ethnic politics, and religious practice (traditional faiths, Islam, and Christianity). In an effort to understand variations of experience within the continent, compares the histories of different regions and countries (e.g., Nigeria vs Uganda), and different social groups (e.g., men vs women).

*D. Ciarlo*

**LATIN AMERICAN HISTORY**

21H.802 Latin America: Revolution, Dictatorship, and Democracy, 1850 to Present
Prereq: —
U (Spring)
3-0-9 HASS

Selective survey of Latin American history from the mid-19th century to the present. Issues studied include: dictators and democracies in the 20th century, revolution in Mexico, Cuba, and Central America, Latin America in the global economy, relations between Latin America and the US, indigenism, feminism, and the varieties of religion in Latin America.

*J. Rovel*

**COMPARATIVE HISTORY SUBJECTS**

21H.909 People and Other Animals
(Subject meets with 21H.969)
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
2-0-10 HASS

A historical exploration of the ways that people have interacted with their closest animal relatives, for example: hunting, domestication of livestock, worship of animal gods, exploitation of animal labor, scientific study of animals, display of exotic and performing animals, and petkeeping. Themes include changing ideas about animal agency and intelligence, our moral obligations to animals, and the limits imposed on the use of animals.

*H. Ritvo*

21H.912 The World Since 1492
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5

Focus on four related themes: struggles between Europeans and colonized peoples; industrialization and the global emergence of capitalist economies; the formation of modern states and the challenges to them; and the development of modern consumer society. Topics include: the French and Haitian Revolutions; the partition of Africa; the two World Wars; and the emergence of advertising. Readings include both historical analysis and documents from the periods under investigation.

*D. Ciarlo*
21H.914 Jewish History from Biblical to Modern Times
Prereq: —
U (Fall)
3-0-9 HASS

How our views of Jewish history have been formed and how this history can explain the survival of the Jews as an ethnic-religious group into the present day. Special attention to the partial and fragmentary nature of our information about the past, and the difficulties inherent in decoding statements about the past that were written with a religious agenda in mind. Consider complex events in Jewish history—from early history as portrayed in the Bible to recent history, including the Holocaust. P. Temin

21H.917J Visualizing Cultures
(Same subject as 21F.027J)
(Subject meets with 21F.590, CMS.874)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H

See description under subject 21F.027J.
S. Miyogawa, J. Dower

21H.927J The Economic History of Work and Family
(Same subject as SP.610J)
(Subject meets with SP.680)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
2-0-7 HASS

Explores men’s and women’s labor time as it is allocated between market and home-production, as well as their differentiated access to the consumption of goods and leisure. The reproductive strategies of women, both in conjunction with and in opposition to their families, is another major theme. How did an ideal of the domestic arise in early modern western Europe? To what extent did it limit the economic position of women? How has that idea been challenged, and with what success in the post-industrial period? Focuses on western Europe since the Middle Ages and on the United States, but also examines how these issues have played themselves out in non-Western cultures. Graduate students are expected to pursue the subject in greater depth through reading and individual research. A. McCants

SPECIAL SUBJECTS IN HISTORY

21H.931 Seminar in Historical Methods
Prereq: Two History subjects
U (Spring)
2-0-10 HASS

Examines different types of historical writing: political, social, cultural, demographic, biographical, environmental, and comparative. Includes discussion of historical films, fiction, memoirs, and conventional history. Particular attention given to works which have broken new ground in terms of their methodology and approach. Required writing includes brief weekly response papers and a substantial research paper (including proposal, first draft, and final draft) in conjunction with a formal oral presentation. Weekly discussion of readings include periodic student-led discussion and/or presentations. Open to all students, but required of history majors and minors in junior year.
D. Ciardo

21H.932 Special Topics in History
Prereq: —
U (Fall, JAP)
Units arranged
Can be repeated for credit
21H.933 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

Individual supervised work for students who wish to study topics not covered in the regular history offerings. Before registering for this subject, a student must plan a course of study with a member of the History Faculty and secure approval from the Head of the History Faculty. HASS credit for Special Topics subjects awarded only by individual petitions to the Committee on Curricula. Normal maximum is 6 units; to count toward HASS Requirement, 9 units are required. Exceptional 9-unit projects occasionally approved.
Staff

21H.934 Special Topics in American History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.942 Special Topics in History
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit

21H.943 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.944 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.945 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.946 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.947 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.948 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.949 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.950 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.951 Special Topics in History
Prereq: —
U (Spring)
Units arranged
Can be repeated for credit

21H.952 Reading Seminar in American History, 1877 to the Present
Prereq: STS.410J
3-0-9 H-LEVEL Grad Credit

Aims to develop a teaching knowledge of the field through extensive reading and discussion of major works. The reading covers a broad range of topics—political, economic, social, and cultural—and represents a variety of historical methods. Students make frequent oral presentations and prepare a 20-page review essay.
M. Jacobs

21H.955 Nature, Environment, and Empire
Prereq: STS.415J
3-0-9 H-LEVEL Grad Credit

An exploration of the relationship between the study of natural history, both domestic and exotic, by Europeans and Americans, and concrete exploitation of the natural world, focusing on the 18th and 19th centuries.
H. Ritvo

21H.968}
21H.969 People and Other Animals (New)
(Subject meets with 21H.909)
Prereq: —
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
2-0-10
A historical survey of the ways that people have interacted with their closest animal relatives, for example: hunting, domestication of livestock, worship of animal gods, exploitation of animal labor, scientific study of animals, display of exotic and performing animals, and petkeeping. Themes include changing ideas about animal agency and intelligence, our moral obligations to animals, and the limits imposed on the use of animals.
H. Ritvo

21H.991 J Theories and Methods in the Study of History
(Same subject as STS.210 J)
Prereq: Permission of instructor
G (Fall)
3-0-9
Focuses on the development of social and cultural history in the twentieth century. Topics include the rise of the Annales school, agrarian history, class, race, and gender as historical categories, historical demography, new economic, and environmental history, microhistory, and history on film. Topics drawn from European, American, and Asian history. Open to qualified undergraduates.
P. C. Perdue

21H.992 Advanced Topics in History
Prereq: —
G (Fall)
Units arranged
21H.993 Advanced Topics in History
Prereq: —
G (Fall)
Units arranged
Individual supervised work for graduate students on a topic or field of history not covered at the graduate level in the regular history offerings. Before registering for this subject, a student must plan a course of study with a member of the History Faculty and secure the approval of the head of the History Faculty.
Staff

21H.995 Advanced Topics in History
Prereq: —
G (Spring)
Units arranged
Individual supervised work for graduate students on a topic or field of history not covered at the graduate level in the regular history offerings. Before registering for this subject, a student must plan a course of study with a member of the History Faculty and secure the approval of the head of the History Faculty.
Staff

21H.996 Advanced Topics in History
Prereq: —
G (Spring)
Units arranged
Individual supervised work for graduate students on a topic or field of history not covered at the graduate level in the regular history offerings. Before registering for this subject, a student must plan a course of study with a member of the History Faculty and secure the approval of the head of the History Faculty.
Staff

The subjects listed below are arranged in four graduated categories or tiers:

1) Introductory subjects (21L.001–21L.017), all carrying HASS Distribution and Communications Intensive (CI-H or CI-HW) credit.

2) Samplings (21L.310–21L.325) are six-unit subjects that provide both an alternative route into literary study and a less intensive means for students to sustain a commitment to reading and textual interpretation. These subjects focus on critical exploration, textual comprehension, and group discussion, with less sustained attention to analytic writing skills. Students can combine two six-unit Samplings subjects to count as a single 12-unit HASS Elective, equivalent to a subject in the Intermediate tier. No more than four Sampling subjects may be combined in this manner.

3) Intermediate subjects (21L.420–21L.512), some carrying HASS Distribution credit and some limited to students who have already taken one literature course. Intermediate subjects explore literary forms in greater depth and center on historical periods, literary themes, or genres. Students are encouraged to consult individual instructors about prerequisite requirements.

4) Seminars (21L.701–21L.715), restricted to students who have taken at least two previous subjects in literature. Enrollment in seminars is strictly limited to a maximum of 12 students.

A supplement to this catalogue, available online and from the Literature Section offices, offers more detailed descriptions of all literature subjects and includes specific information about required texts, writing assignments, and examinations.

INTRODUCTORY SUBJECTS

21L.000| Writing About Literature
(Same subject as 21W.734)
Prereq: —
U (Fall, Spring)
3-0-9 HASS, CI-HW

Intensive focus on the reading and writing skills used to analyze literary texts such as poems by Emily Dickinson, Shakespeare or Langston Hughes; short stories by Chekhov, Joyce, or Alice Walker; and a short novel by Melville or Toni Morrison. Designed not only to prepare students for further work in writing and literary and media study, but also to provide increased confidence and pleasure in their reading, writing, and analytical skills. Students write or revise essays weekly. Enrollment limited.

21L.001 Foundations of Western Culture: Homer to Dante
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H

Studies a broad range of texts essential to understanding the two great sources of Western conceptions of the world and humanity’s place within it: the ancient world of Greece and Rome and the Judeo-Christian world that challenged and absorbed it. Readings vary but usually include works by Homer, Sophocles, Aristotle, Plato, Virgil, St. Augustine, and Dante. Enrollment limited.

Spring: A. Bahr

21L.002 Foundations of Western Culture: The Making of the Modern World
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 2, CI-H

Complementary to 21L.001. A broad survey of texts, literary, philosophical, and sociological, studied to trace the growth of secular humanism, the loss of a supernatural perspective upon human events, and changing conceptions of individual, social, and communal purpose. Stresses appreciation and analysis of texts that came to represent the common cultural possession of our time. Enrollment limited.

H. Eiland

21L.003 Reading Fiction
Prereq: —
U (Fall, Spring)
3-0-9 HASS-D, Category 1, CI-H

Introduces prose narrative, both short stories and the novel. Examines the construction of narrative and the analysis of literary response. Enrollment limited.

Fall: S. Alexanbre, I. Lipkowitz
Spring: A. Braithwaite, S. Brouillette

21L.004 Reading Poetry
Prereq: —
U (Fall, Spring)
3-0-9 HASS-D, Category 1, CI-H

Emphasis on lyric poetry in England and the US. Syllabus usually includes sonnets by Shakespeare, selections from Milton’s Paradise Lost, individual poems by Donne, Keats, Dickinson, Frost, Eliot, Langston Hughes, Lowell, and Plath. Enrollment limited.

Fall: N. Jackson, S. Tapscott
Spring: J. Hildebidle, M. Fuller

21L.005 Introduction to Drama
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 3, CI-H

A study of the history of theater art and practice from its origins to the modern period, including its roles in non-Western cultures. Special attention to the relationship between the literary and performative dimensions of drama, and the relationship between drama and its cultural context. Enrollment limited.

A. Bahr

21L.006 American Literature
Prereq: —
U (Fall, Spring)
3-0-9 HASS-D, Category 1, CI-H

Studies the national literature of the US since the early 19th century. Considers novels, essays, films, and poems, focusing on efforts to define and reform a sense of American identity amidst increasing awareness of cultural diversity. Readings usually include works by Hawthorne, Thoreau, Frederick Douglass, Dickinson, Frost, Faulkner, Maxine Kingston, and Amy Tan. Enrollment limited.

Fall: J. Hildebidle
Spring: S. Alexandre

s u b j e c t s 2 1 H . 9 6 9 t o 2 1 L . 0 0 6
21L.007 World Literatures
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 1, CI-H
Introduces students to a coherent set of textual and visual materials drawn from different geographical regions, languages, artistic genres, and historical periods. The focus may vary but usually cuts across national boundaries. Includes non-English works read in translation and examines different kinds of writing, both fiction and nonfiction. Pays special attention to such issues as identity formation, cultural contact, exploration, and exile. Previously taught topics include contemporary writing from Africa and South Asia, the impact of the discovery of the New World, and Caribbean literature.
A. Braithwaite, S. Brouillette

21L.009 Shakespeare
Prereq: —
U (Fall, Spring)
3-0-9 HASS-D, Category 1, CI-H
Close study of the major comedies, histories, and tragedies in the context of Renaissance thought, Elizabethan theatre, and the political and social setting of Shakespeare’s age. Lectures and class discussions each week, supplemented by occasional reading of scenes and attendance at live or filmed performances. Enrollment limited.
Fall: S. Raman
Spring: P. Donaldson, H. Eiland

21L.011 The Film Experience
Prereq: —
U (Fall, Spring)
3-3-6 HASS-D, Category 3, CI-H
An introduction to narrative film, emphasizing the unique properties of the movie house and the motion picture camera, the historical evolution of the film medium, and the intrinsic artistic qualities of individual films. Syllabus varies from semester to semester, but usually includes such directors as Griffith, Chaplin, Renoir, Ford, Hitchcock, De Sica, and Fellini.
Fall: D. Thorburn
Spring: M. Marks

21L.012 Forms of Western Narrative
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 1, CI-H
Examines forms of storytelling that have developed in Western cultures from Homer to the present. Emphasis on literary and cultural issues; the emergence of different narrative genres and media; story forms as anthropo-logical artifacts. Syllabus varies but usually includes folk tales, and authors such as Homer, Sophocles, Cervantes, Laclos or Tolstoy, Poe, and at least one film.

J. Bazard

21L.015 Introduction to Media Studies
Prereq: —
U (Fall)
3-3-6 HASS-D, Category 4, CI-H
Offers an overview of the social, cultural, political, and economic impact of mediated communication on modern culture. Combines critical discussions with experiments working with different media. Media covered include radio, television, film, the printed word, and digital technologies. Topics include the nature and function of media, core media institutions, and media in transition.
B. Coleman

21L.016 Learning from the Past: Drama, Science, Performance
(Subject meets with 21M.616)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 3, CI-H
Explores the creation (and creativity) of the modern scientific and cultural world through study of western Europe in the 17th century, the age of Descartes and Newton, Shakespeare, Rembrandt and Molière. Compares period thinking to present-day debates about the scientific method, art, religion, and society. This team-taught, interdisciplinary subject draws on a wide range of literary, dramatic, historical, and scientific texts and images, and involves theatrical experimentation as well as reading, writing, researching and conversing. Meets most of the time with 21M.616, but differs from it in emphasizing cultural and literary analysis.
D. Henderson

21L.017 The Art of the Probable
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H
Examines literary texts and films in relation to the history of the idea of probability. Traces the growing importance of probability both as a measure of the reliability of ideas or beliefs and also as a basic property of things and the world. Connects the development and use of probabilistic reasoning (e.g., in the lottery, the insurance industry, and the stock market) with literary and cultural concerns regarding the rationality of belief, risk and uncertainty, free will and determinism, chance and fate. Discussion of the work of scientific and philosophical pioneers of probabilistic thought (e.g., Pascal, Leibniz, Bernoulli, Laplace, and Einstein) in conjunction with a variety of literary texts and films, including works of Shakespeare, Jane Austen, H. G. Wells, and classic Hollywood cinema.
N. Jackson, A. Kibel, S. Raman

SAMPLINGS

21L.310 Bestsellers
Prereq: —
U (Fall)
2-0-4
Can be repeated for credit once if content differs
Focuses on works that caught the popular imagination in the past or present. Emphasizes texts that are related by genre, theme or style. Books studied vary from term to term. Topic for Fall: Detective Fictions. Enrollment limited.
S. Tapscott

21L.315 Prizewinners
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
2-0-4
Can be repeated for credit
Examines the work of major prize-winning writers or filmmakers. Texts and authors are chosen that have won such prestigious literary awards as the Nobel Prize, the Booker Prize, or the National Book Award, or films that have been feted at major international film festivals. Authors and works vary from term to term. Topic for Spring: Nobel Laureates—Derek Walcott and Seamus Heaney. Enrollment limited.
Staff

21L.320 Big Books
Prereq: —
U (Fall)
2-0-4
Can be repeated for credit
Intensive study of a single major literary work or a very small set of related literary works. Emphasizes texts that encourage close analysis in a way that cannot easily be integrated into the regular literature curriculum. Content varies from term to term. Enrollment limited.
W. Kelley
INTERMEDIATE SUBJECTS

Genres and Themes

See also SP.433.

21L.420 Literary Studies: The Legacy of England
Prereq: One subject in Literature
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Examines English literature across genre and historical period. Designed for students who wish to study English literature or writing in some depth, or wish to know more about English literary culture and history. Learn about the relationships between literary themes, forms, and conventions and the times in which they were produced. Students examine Renaissance lyrics, Enlightenment satire, and modernist short stories. Focused on England because of its historical importance and its usefulness as an example for illustrating patterns over the centuries. Students form a framework for understanding how more focused subjects fit into literary traditions and what terms, concerns, and methods provide connections among the diverse subjects grouped under “literature.”
Staff

21L.421 Comedy
Prereq: —
U (Fall, Spring)
3-3-6 HASS-D, Category 1, CI-H

Surveys a range of comic texts in different media, the cultures that produced them, and various theories of comedy. Authors and directors studied may include Aristophanes, Shakespeare, Molière, Austen, Wilde and Chaplin. Fall: H. Eiland
Spring: W. Kelley

21L.422 Tragedy
Prereq: —
U (Spring)
3-0-9 HASS

Aspects of the tragic as a mode of literature and a quality of lived experience pursued in readings that extend from the warfare of the ancient world to the experiences of modern life. Authors include Aeschylus, Sophocles, Euripides, Shakespeare, Balzac, Tolstoy, Ibsen, Conrad, Dinesen, Faulkner, and Camus. Includes viewing of at least two films.
H. Eiland

21L.423] Folk Music of the British Isles and North America
(Same subject as 21M.223J)
Prereq: —
U (Fall)
3-1-8 HASS-D, Category 3, CI-H
See description under subject 21M.223J.
G. Ruckert, R. Perry

21L.430 Popular Narrative
(Subject meets with SP.492, CMS.920)
Prereq: —
U (Spring)
3-3-6 HASS
Can be repeated for credit with permission of instructor

Examines the relationship between popular and high culture and the problem of evaluating texts that tell stories. Treats a range of narrative and dramatic works as well as films. Previously taught topics include Masterminds, and Popular Culture in an Age of Media Convergence.
A. Braithwaite

21L.432 Understanding Television
(Subject meets with CMS.840)
Prereq: One subject in Literature or Comparative Media Studies
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-3-6 HASS
Can be repeated for credit with CMS.915, but assignments differ.
A. Kibel

21L.433 Film Styles and Genres
Prereq: 21L.011 or permission of instructor
U (Fall)
3-3-6 HASS
Can be repeated for credit with permission of instructor

Close study of one or more directors, genres, periods, artistic movements, or national cinemas which have been of major significance in the history of film. Previously taught topics include Hollywood and Hong Kong, and Movie Realists: Chaplin, Renoir, Neorealism, Truffaut.
Staff

21L.434 Science Fiction and Fantasy
Prereq: —
U (Fall)
3-3-6 HASS

Traces the history of science fiction as a generic tradition in literature, media, and popular culture. Considers formal, ideological and cultural approaches to the analysis and interpretation of science fiction and fantasy texts.
Staff

21L.435 Literature and Film
(Subject meets with CMS.840)
Prereq: One subject in Literature or Comparative Media Studies
U (Spring)
3-3-6 HASS
Can be repeated for credit

Investigates relationships between the two media, including film adaptations as well as works linked by genre, topic, and style. Explores how artworks challenge and cross cultural, political, and aesthetic boundaries. Previously taught topics include Shakespeare, Film and Media. Meets with CMS.840, but assignments differ.
A. Kibel

21L.448J Darwin and Design
(Same subject as 21W.739J)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 2, CI-H

In The Origin of Species, Darwin provided a model for understanding the existence of objects and systems manifesting evidence of design without positing a designer, and of purpose and mechanism without intelligent agency. Texts deal with pre-Darwinian and later treatment of this topic within literature and speculative thought since the 18th century, with
some attention to the modern study of feedback mechanism in artificial intelligence. Readings in Hume, Voltaire, Malthus, Darwin, Butler, Hardy, H. G. Wells, and Freud. A. Kibel, J. Paradis

21L.449 End of Nature
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
A brief history of conflicting ideas about mankind’s relation to the natural environment as exemplified in works of poetry, fiction, and discursive argument from ancient times to the present. What is the overall character of the natural world? Is mankind’s relation to it one of stewardship and care, or of hostility and exploitation? Readings include Aristotle, The Book of Genesis, Shakespeare, Descartes, Robinson Crusoe, Swift, Rousseau, Wordsworth, Darwin, Thoreau, Faulkner, and Lovelock’s Gaia. A. Kibel

21L.450 Literature and Ethical Values
Prereq: One subject in Literature
U (Fall)
3-0-9 HASS
Examines competing ethical concepts and the ethical implications of certain actions and commitments by close reading of literary works. Topics include origins of morality, ideals of justice, the nature of the virtues, notions of responsibility, ethics and politics, and the ethics of extreme situations. Philosophic texts by Plato, Aristotle, Machiavelli, Hobbes, and Kant. Narrative and dramatic texts by Sophocles, Euripides, Shakespeare, Swift, Ibsen, Shaw, Dostoyevsky, and Conrad, plus some Biblical materials. A. Kibel

21L.451 Introduction to Literary Theory
Prereq: —
U (Spring)
3-0-9 HASS
Examines the ways texts can be read and questions that readers ask of texts. Aims to provide students with a sense of the different critical approaches to literature. Topics include: structuralism and semiotics; post-structuralism and post-modernism; historicism and historicist paradigms; psychoanalysis; intertextuality; and cultural criticism. S. Raman

21L.455 Classical Literature
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
Can be repeated for credit
Explores the classical roots of Western civilizations through a close examination of the social and cultural contexts in which selected literary texts were first produced, the influence of political structures and ideologies, the function of rhetorical forms, the purpose and significance of ancient mythologies, and the relation of literature to shared developments in art, architecture, and religion. Texts taught in translation, but direct readings in the original languages are encouraged. Authors include Livy, Lucretius, Cicero, Julius Caesar, Virgil, Horace, and Ovid. Enrollment limited. A. Bahr

21L.458 The Bible
Prereq: —
U (Fall, Spring)
3-0-9 HASS
An introduction to major books from both the Hebrew Bible and the New Testament. Particular attention is given to literary techniques, issues resulting from translation from the original Hebrew and Greek, and the different historical periods that produced and are reflected in the Bible. A study of the Bible as influence in later narrative, philosophic, and artistic traditions. I. Lipkowitz

Periods of World Literature

21L.460 Medieval Literature
(Subject meets with SP.514)
Prereq: One subject in Literature
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS, CI-H
Can be repeated for credit
Surveys a range of literary works across different European cultures from the Roman Empire to the beginnings of the Renaissance. Literary movements and cultural developments discussed in their social, political, and historical contexts. Topics covered include the growth of religious communities, the shift from orality to literacy, the culture of chivalry and courtly love, the emergence of scholasticism and universities, changes in devotional practices and popular piety, religious intolerance and the Crusades, and the rise of nationalism and class consciousness. Previously taught topics include Medieval Women Writers, The Crusades, and Dante, Boccaccio and Chaucer. Enrollment limited. A. Bahr

21L.463 Renaissance Literature
Prereq: One subject in Literature
Acad Year 2007–2008: Not offered
U (Spring)
3-0-9 HASS, CI-H
Readings are organized around topics (Renaissance self-fashioning, courtship and courtiership, gender and the emerging individual) or literary genres (lyric, epic, drama, prose). Works drawn primarily from the Italian and English Renaissance, and may include such figures as Petrarch, Shakespeare, More, Jonson, Machiavelli, Castiglione, Milton, Spenser, Bacon, Donne, and Sidney. Previously taught topics include Renaissance Poetry and Strivers and Slackers. Enrollment limited. S. Raman

21L.470 Eighteenth-Century Literature
Prereq: One subject in Literature
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
An examination of 18th-century English writers in their historical context. Authors James Thomson, Joseph Addison, Laurence Sterne, Mary Robinson, and Mary Wollstonecraft address issues of capitalism and class mobility; romantic love and the changing definition of femininity and masculinity; the mutual emergence of mass culture and of high-cultural aesthetics; and colonialism and international travel. Previously taught topics include Gods and Monsters: Versions of the Self in 18th-century Britain. Staff

21L.471 Major English Novels
Prereq: One subject in Literature
U (Spring)
3-0-9 HASS
Can be repeated for credit
Studies important examples of the literary form that, between the beginning of the 18th century and the end of the 19th century, became an indispensable instrument for representing modern life, in the hands of such writers as Defoe, Richardson, Fielding, Sterne, Burney, Austen, Scott, Dickens, the Brontës, Eliot, Hardy, and Conrad. The class alternates between 18th and 19th century topics. A. Kibel
21L.472 Major European Novels  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9 HASS, CI-H  
Staff  

21L.473J Jane Austen  
(Same subject as SP.513J)  
Prereq: One subject in Literature  
U (Fall)  
3-0-9 HASS  
An examination of Jane Austen’s satire in her seven complete novels, several fragments, and juvenilia. Students read these texts in relation to her letters and other biographical and historical information. Instruction and practice in oral and written communication provided. Enrollment limited.  
R. Perry  

21L.476 Romantic Poetry  
Prereq: One subject in Literature  
U (Spring)  
3-0-9 HASS  
Close readings of the major British Romantic poets (Blake, Wordsworth, Coleridge, Byron, Scott, Shelley, and Keats) and important fiction writers (Mary Shelley and Walter Scott). Attention given to literary and historical contexts.  
N. Jackson  

21L.481 Victorian Literature and Culture  
Prereq: One subject in Literature  
Acad Year 2007–2008: Not offered  
U (Fall)  
3-0-9 HASS  
Can be repeated for credit  
British literature and culture during Queen Victoria’s long reign, 1837–1901. Authors studied may include Charles Dickens, the Brontës, Lewis Carroll, George Eliot, Robert Browning, Oscar Wilde, Arthur Conan Doyle, Rudyard Kipling, and Alfred Lord Tennyson. Discussion of many of the era’s major developments such as urbanization, steam power, class conflict, Darwin, religious crisis, imperial expansion, information explosion, and bureaucratization. Fiction, nonfiction, and poetry; syllabi vary.  
J. Buzard  

21L.485 Modern Fiction  
Prereq: One subject in Literature  
U (Spring)  
Units arranged HASS  
Tradition and innovation in representative fiction of the early modern period. Recurring themes include the role of the artist in the modern period; the representation of psychological and sexual experience; and the virtues (and defects) of the aggressively experimental character. Works by Conrad, Kipling, Babel, Kafka, James, Lawrence, Mann, Ford Madox Ford, Joyce, Woolf, Faulkner, and Nabokov. Students register for 9 or 12 units of credit, depending on the intensity of the writing assignments. Contact the professor to determine appropriate units.  
D. Thorburn  

21L.486 Modern Drama  
Prereq: One subject in Literature  
Acad Year 2007–2008: U (Spring)  
Acad Year 2008–2009: Not offered  
3-0-9 HASS, CI-H  
Staff  

21L.487 Modern Poetry  
Prereq: One subject in Literature  
U (Fall)  
3-0-9 HASS  
J. Hildebidle  

21L.488 Contemporary Literature  
Prereq: One subject in Literature  
U (Spring)  
3-0-9 HASS  
Focus on fiction, poetry, and drama of recent decades. Previously taught topics include New Irish Writing, and Contemporary Novels and Poetry.  
S. Brouillette  

21L.489J Interactive and Non-Linear Narrative: Theory and Practice  
(Same subject as 21W.765J)  
(Subject meets with CMS.845)  
Prereq: —  
U (Fall)  
3-0-9 HASS  
See description under subject 21W.765J.  
E. Barrett  

21L.490J French Literature in Translation  
(Same subject as 21F.050J)  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
3-0-9 HASS  
See description under subject 21F.050J.  
E. B. Turk  

American Literature  
See also 21L 006.  

21L.501 The American Novel  
Prereq: —  
U (Spring)  
3-0-9 HASS, CI-H  
Works by major American novelists, beginning with the late 18th century and concluding with a contemporary novelist. Major emphasis on reading novels as literary texts, but attention paid to historical, intellectual, and political contexts as well. Syllabus varies from term to term, but many of the following writers are represented: Rowson, Hawthorne, Melville, Twain, Wharton, James, and Toni Morrison. Previously taught topics include The American Revolution. Enrollment limited.  
S. Alexandre  

21L.504J Race and Identity in American Literature  
(Same subject as SP.518J)  
Prereq: —  
U (Fall)  
3-0-9 HASS  
Questions posed by the literature of the Americas about the relationship of race and gender to authorship, audience, culture, ethnicity, and aesthetics. Social conditions and literary histories that shape the politics of identity in American literature. Specific focus varies each term. Previously taught topics include Cultural Encounters from 1492 to the Civil War, Immigrant Stories, African American Literature, and Asian American Literature.  
S. Alexandre
21L.512 American Authors  
(Subject meets with SP.517)  
Prereq: One subject in Literature  
U (Fall)  
3-0-9 HASS

Examines in detail the works of several American authors selected according to a theme, period, genre, or set of issues. Through close readings of poetry, novels, or plays, subject addresses such issues as literary influence, cultural diversity, and the writer’s career. Previously taught topics include American Women Writers, Hemingway, and American Short Fiction.  

A. Braithwaite

21L.703 Studies in Drama  
Prereq: Two subjects in Literature  
U (Fall)  
3-0-9 HASS

Can be repeated for credit

Intensive study of an important topic or period in drama. Close analysis of major plays, enriched by critical readings and attention to historical and theatrical contexts. Instruction and practice in oral and written communication through student presentations and research essays. Previously taught topics include Renaissance Drama, Shakespeare with his Contemporaries, and Tom Stoppard, Caryl Churchill. Enrollment limited to 12.  

D. Henderson

21L.704 Studies in Poetry  
Prereq: Two subjects in Literature  
U (Fall, Spring)  
3-0-9 HASS

Can be repeated for credit


Fall: N. Jackson  
Spring: J. Hildebidle

21L.705 Major Authors  
(Subject meets with SP.512)  
Prereq: Two subjects in Literature  
U (Spring)  
3-0-9 HASS

Can be repeated for credit

Close study of a limited group of writers. Instruction and practice in oral and written communication. Previously taught topics include John Milton and his Age, Chaucer, Herman Melville, Toni Morrison, and Oscar Wilde and the ’90s. Enrollment limited to 12.  

M. Fuller

21L.706 Studies in Film  
(Subject meets with CMS.830)  
Prereq: 21L.011 and one subject in Literature or Comparative Media Studies, or permission of instructor  
U (Spring)  
3-3-6 HASS

Can be repeated for credit

Intensive study of films of a particular period or genre, or films by a single director. Instruction and practice in oral and written communication. Meets with CMS.830, but assignments differ. Previously taught topics include Technologies of Seeing: Pre-Cinema to Early Cinema, Hollywood/Bollywood, Film Analysis and Shakespeare on Film.  

P. Donaldson

21L.707 Problems in Cultural Interpretation  
Prereq: Two subjects in Literature or permission of instructor  
U (Fall)  
3-0-9 HASS

Can be repeated for credit

Studies the relation between imaginative texts and the culture surrounding them. Emphasizes ways in which imaginative works absorb, reflect, and conflict with reigning attitudes and world views. Instruction and practice in oral and written communication. Previously taught topics include Women Reading/Women Writing, Poetry, Passion, and the Self, Arthurian Literature and the Colonization of the Celts, and Race, Religion and Identity in Early Modern America. Enrollment limited to 12.  

S. Raman

21L.708 Literature and Technology  
(Subject meets with CMS.910)  
Prereq: Two subjects in Literature and/or Comparative Media Studies or permission of instructor  
Acad Year 2007–2008: Not offered  
U (Spring)  
3-0-9 HASS

Can be repeated for credit

Examines the relationship between literary or artistic artifacts and the particular technologies through which they were produced and disseminated. In what ways do the actual technical practices of composition affect the nature of what is produced? How are artistic works influenced by the emergence of new technical possibilities and processes? Topics studied vary from semester to semester. Previously taught topics include the emergence of hypertexts and hyper-realities; Shakespeare across media; and the effect of the printing press on the development of Renaissance humanism.  

K. Fendt

21L.709 Studies in Literary History  
Prereq: Two subjects in Literature or History  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9 HASS

Can be repeated for credit

Close examination of the literature of a particular historical period. Syllabi vary. Instruction
and practice in oral and written communication. Enrollment limited to 12.

**21L.715 Media in Cultural Context**
(Subject meets with SP.493, CMS.871)
Prereq: Two subjects in Literature and/or Comparative Media Studies, or permission of instructor
U (Fall)
3-3-6 HASS
Can be repeated for credit
Seminar designed to provide close case study examinations of specific media or media configurations and the larger social, cultural, economic, political, or technological contexts within which they operate. Subject organized around recurring themes in media history, specific genres or movements, specific media, or specific historical moments. Instruction and practice in written and oral communication provided. Previously taught topics include Gendered Genres: Horror and Maternal Melodramas, Comics, Cartoons, and Graphic Storytelling, and Exploring Children’s Culture. Meets with CMS.871, but assignments differ. Limited to 12.

*S. Brouillette*

**21L.996, 21L.997 Topics in Film and Media**
Prereq: Two subjects in Film and Media; permission of director of Comparative Media Studies
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit with permission of instructor
Open to qualified students who wish to pursue special projects in film and media studies faculty. Individual or small group projects encouraged. Usually limited to 6 credits.

*H. Jenkins*

**21L.998, 21L.999 Special Topics in Literature**
Prereq: Two subjects in Literature; permission of Literature Faculty Chair
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit with permission of instructor
Open to qualified students who wish to pursue special studies or projects with members of the Literature faculty. Normal maximum is 6 units, though exceptional 9-unit projects are occasionally approved.

*Staff*

**21L.ThT Literature Pre-Thesis Tutorial**
Prereq: —
U (Fall, Spring)
1-0-5
Can be repeated for credit
Definition of and early-stage work on thesis project leading to 21L.ThU. Taken during the first term of the student’s two-term commitment to the thesis project. Student works closely with an individual faculty tutor. Required for students in Course 21L when the thesis is a degree requirement.

*Staff*

**21L.ThU Literature Thesis**
Prereq: 21L.ThT
U (Fall, Spring)
Units arranged
Can be repeated for credit
Completion of work on the senior major thesis under supervision of a faculty tutor. Includes oral presentation of thesis progress early in the term, assembling and revising the final text, and meeting at the close with a committee of faculty evaluators to discuss the successes and limitations of the project. Required for students in Course 21L when the thesis is a degree requirement.

*Staff*

**21L.UR Undergraduate Research**
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

**21L.URG Undergraduate Research**
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Individual participation in an ongoing research project. For students in the Undergraduate Research Opportunities Program.

*Consult J. Buzard*

MUSIC

The Music subjects described below are grouped within six areas: Introductory, History/Literature, Theory/Composition, Performance, Special Topics/Advanced Subjects, and Music and Media.

Although most students start with introductory subjects, those who have vocal or instrumental training or extensive exposure to music are encouraged to begin at a higher starting level.

Introductory Subjects

21M.011 Introduction to Western Music
Prereq: —
U (Fall, Spring)
4-0-8 HASS-D, Category 3, CI-H

Gives students a broad overview of Western music from the Middle Ages to the 20th century, with emphasis on late baroque, classical, romantic, and modernist styles. Enhances the musical experience by developing listening skills and an understanding of diverse forms and genres. Major composers and works placed in social and cultural contexts. Weekly lectures feature demonstrations by professional performers, and introduce topics to be discussed in sections. Enrollment may be limited.

Fall: M. Marks, T. Neff, A. Boyles
Spring: G. Ruckert, T. Neff

21M.013] The Supernatural in Music, Literature and Culture (New)
(Same subject as 21A.113)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 3, CI-H

Explores the relationship between music and the supernatural, focusing on the social history and context of supernatural beliefs as reflected in key literary and musical works from 1600 to the present. Provides a better understanding of the place of ambiguity and the role of interpretation in culture, science and art. Explores great works of art by Shakespeare, Verdi, Goethe (in translation), Gounod, Henry James and Benjamin Britten. Readings will also include selections from the most recent scholarship on magic and the supernatural. Writing assignments will range from web-based projects to analytic essays.

No previous experience in music is necessary. Projected guest lectures, musical performances, field trips.

E. Harris, J. Howe, C. Shadle

21M.026 Jazz
Prereq: —
U (Fall, Spring)
3-0-9 HASS-D, Category 3

Historical survey from roots in African and American contexts, including spirituals, blues, and ragtime, through early jazz, Swing, bebop, and post-bop movements, with attention to recent developments. Key jazz styles, the relation of music and society, and major figures such as Armstrong, Ellington, Basie, Goodman, Parker, Monk, Mingus, Coltrane, and others are considered. Some investigation of cross-influences with popular, classical, folk, and rock musics. Enrollment may be limited.

M. Harvey

21M.030 Introduction to World Music
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 3, CI-H

An introduction to diverse musical traditions of the world. Music from a wide range of geographical areas is studied in terms of structure, performance practice, social use, aesthetics, and cross-cultural contact. Includes hands-on music making, live demonstrations by guest artists, and ethnographic research projects.

P. Tang, G. Ruckert

21M.065 Introduction to Musical Composition
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 3

Through a progressive series of composition projects, students investigate the sonic organization of musical works and performances, focusing on fundamental questions of unity and variety. Aesthetic issues are considered in the pragmatic context of the instructions that composers provide to achieve a desired musical result, whether these instructions are notated in prose, as graphic images, or in symbolic notation. No formal training is required. Weekly listening, reading, and composition assignments draw on a broad range of musical styles and intellectual traditions, from various cultures and historical periods.

K. Makan

History/Literature

21M.215 American Music
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

A survey of music in the US from the colonial period to the present in the context of American cultural history, with an emphasis on Boston’s musical life whenever feasible. Listening and writing assignments concern classical, popular, folk, musical theater, and jazz repertories.

M. Harvey

21M.220 Early Music
Prereq: 21M.011, 21M.051, 21M.301, or permission of instructor
U (Spring)
3-0-9 HASS

Studies key genres and styles of vocal and instrumental music that developed across Europe in churches, courts, and public venues prior to the age of “common practice” harmony. After a survey of the medieval background, focuses on works by great Renaissance and early baroque composers, including Dunstable, Dufay, Ockeghem, Josquin, Willaert, Palestrina, Lasso, Victoria, Byrd, Gibbons, Monteverdi, Gabrieli, Praetorius, and Schutz. Student assignments
21M.223J Folk Music of the British Isles and North America
(Same subject as 21L.423J)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 3, CI-H
Examines the production, transmission, preservation and the qualities of folk music in the British Isles and North America from the 18th century to the folk revival of the 1960s and the present. Special emphasis on balladry, fiddle styles, and African-American influences.
G. Ruckert, R. Perry

21M.230 Vivaldi, Bach, and Handel
Prereq: —
U (Fall)
3-0-9 HASS, CI-H
Listening assignments sample all genres composed by the three great masters and by four of their contemporaries. Reading assignments concern the structural, textural and performance aspects of music and trace contemporary intellectual, artistic and social changes. Written essays and oral presentations are based on assigned listening and reading. Requires some knowledge of score-reading and attendance at two or three performances. Enrollment limited.
L. Lindgren

21M.240 Haydn, Mozart, and Beethoven
Prereq: Permission of instructor
U (Spring)
3-0-9 HASS, CI-H
Listening assignments sample all genres composed by the three great masters and by a few of their contemporaries. Reading assignments regard structural, textural and performance aspects of music and its placement within cultural contexts. Written essays and oral presentations concern the assigned repertoire. Requires some knowledge of score-reading and attendance at two or three performances. Enrollment limited.
L. Lindgren

21M.250 Schubert to Debussy
Prereq: Permission of instructor
U (Fall)
3-0-9 HASS
A survey of developments in Western musical style, 1815–1915. Works by 35 composers, including the romantics: Schubert, Chopin, and Schumann; the post-romantics: Wagner, Verdi, and Brahms; the turn-of-the-centurians: Mahler, Debussy, and Ravel; and the Americans: Gottschalk, Beach, and Joplin. Score-reading ability is beneficial.
C. Shadle

21M.252 Song
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS, CI-H
A history of song from the time of Shakespeare to the present, examining ways in which individual composers of different periods and nationalities have responded to great poetry. Songs examined are chosen from a variety of composers, such as Schubert, Debussy, and Stravinsky, and studied in close connection with their texts, which include poetry by Shakespeare, Milton, Goethe, and Verlaine. Performing experience is welcomed but not required. Required reading, listening, and writing assignments. Ability to read music required. Enrollment limited.
E. Harris

21M.262 Modern Music: 1900–1960
Prereq: Ability to read music
U (Fall)
3-0-9 HASS
A survey of major works from Europe and America, spanning the first six decades of the 20th century. Divided into three periods: 1900 to World War I; WWI to WWII; and 1945 to the early 1960s. Roughly 15 works represent each period. The following composers receive greatest attention: Schoenberg, Berg, Webern, Ravel, Stravinsky, Prokofiev, Shostakovich, Ives, Britten, Messiaen, Stockhausen, and Carter.
M. Cuthbert

21M.263 Music Since 1960
Prereq: One subject in music or permission of instructor
U (Spring)
3-0-9 HASS
Begins with the premise that the 1960s marked a great dividing point in the history of 20th-century Western musical culture, and explores the ways in which various social and artistic concerns of composers, performers, and listeners have evolved since that decade. Focuses on works by classical composers from around the world. Topics include the impact of rock, as it developed during the 1960s–1970s; the concurrent emergence of post serial, neotonal, minimalist, and new age styles; the globalization of Western musical traditions; the impact of new technologies; and the significance of music video, video games, and other versions of multimedia. Interweaves discussion of these topics with close study of seminal musical works, evenly distributed across the four decades since 1960. Works by MIT composers included.
M. Cuthbert

21M.271 Symphony and Concerto
Prereq: Permission of instructor
U (Fall)
3-0-9 HASS
Listening assignments include 34 symphonies and 24 concertos, composed from the 1720s to the 1990s. Class discussion and oral presentations focus on the works in 18 miniature scores. Each of the three written papers reviews a concert attended during the term.
L. Lindgren

21M.273 Opera
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
Focus on the text, music and staging of excerpts from nearly 50 works, including 15 by Mozart, Wagner and Verdi. Live performances are the basis for four written papers. Works composed during the last 125 years are the basis for two oral presentations. Enrollment limited.
L. Lindgren

21M.274 Shakespeare at the Opera
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Study of operas based on Shakespeare’s plays, examining the conventions governing the use of music in the original plays, the suitability of the play to operatic adaptation, and the differing conventions and traditions of spoken theater and opera in the representation of time, the development of character, and the structure of the plot. Operas might include Gounod’s Romeo et Juliette, Berlioz’s Beatrice et Benedict, Verdi’s Macbeth, Otello, or Falstaff, Britten’s Midsummer Night’s Dream, and Barber’s Antony and Cleopatra. Required reading and listening assignments.
E. Harris, M. Ouellette
21M.283 Musicals of Stage and Screen
Prereq: One subject in film, music, or theater; or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Covers Broadway works and Hollywood films in depth. Proceeds chronologically, exploring three stage musicals and three films at a time, within four historical categories: breakthrough musicals of the 1920s and ’30s; classic “book musicals” of the ’40s and ’50s; modernist and concept musicals of the ’60s and ’70s; and post modern and cutting-edge works of the ’80s and ’90s. Attention given to the role of music in relation to script, characterization, and dramatic structure. Final papers involve comparison of one stage and one film work, selected in consultation with the instructor. Oral presentations required and in-class performances encouraged.
_M. Marks_

21M.284 Film Music
(Subject meets with CMS.925)
Prereq: —
U (Spring)
3-3-6 HASS
Surveys the styles and dramatic functions of music in sound films from the 1930s to the present. Predominant attention given to landmark scores by American and European composers, including Korngold, Steiner, Rozsa, Raksin, Prokofiev, Copland, Herrmann, Rota, Morricone, Williams, and Elfman. Subsidiary topics include new trends in contemporary film-scoring; pop scores; the impact of electronics, and specialized genres (e.g., westerns, musicals, documentaries, animated films). Viewing, listening, and reading assignments. Some background in the study of film and/or music is expected.
_M. Marks_

21M.291 Music of India
Prereq: —
U (Spring)
3-0-9 HASS
Focuses on Hindustani classical music of North India, and also involves learning about the ancient foundations of the rich classical traditions of music and dance of all Indian art and culture. Practice of the ragas and talas through the learning of songs, dance, and drumming compositions. Develops insights through listening, readings, and concert attendance.
_G. Ruckert_

21M.292 Music of Indonesia
Prereq: —
U (Spring)
2-2-8 HASS
Provides an introduction to the fascinating, intricate music of Indonesia. The Indonesian archipelago is home to a wide variety of cultures and musical traditions, many of them largely unknown in the West. From the Gamelan percussion orchestras of Bali and Java to the indigenous folk traditions of Sumatra and Borneo, and Western-influenced pop and street traditions.
P. Tang

21M.293 Music of Africa
Prereq: —
U (Fall)
3-0-9 HASS
Focuses on musical traditions of West Africa. A variety of musical practices and their cultural contexts are explored through listening, reading, and writing assignments with an emphasis on class discussion. Subject includes in-class instruction in Senegalese drumming, song and dance, as well as live lecture-demonstrations by guest performers from throughout West Africa.
P. Tang

21M.294a Popular Musics of the World
Prereq: —
U (Spring)
3-0-9 HASS
Focuses on popular music created for and transmitted by mass media. Various popular music genres from around the world are studied through listening and reading assignments, while considering issues of musical change, syncretism, Westernization, globalization, the impact of recording industries, and the post-colonial era. Case studies include bhangra, Afro-pop, reggae, and global hip-hop.
P. Tang

Theory/Composition

21M.301 Harmony and Counterpoint I
Prereq: 21M.051 or permission of instructor
U (Fall, Spring)
3-3-6 HASS-D, Category 3
Basic writing skills in music of the common-practice period (Bach to Brahms). Work includes regular written assignments leading to the composition of short pieces, analyzing representative works from the literature, keyboard laboratory, and sight-singing choir. It is recommended that entering students have some concert music listening or playing background. Enrollment may be limited.
Fall: P. Child, M. Cuthbert, G. Ruckert, C. Hughes, S. Cleveland
Spring: C. Shadle, M. Harvey, C. Hughes, S. Cleveland

21M.302 Harmony and Counterpoint II
Prereq: 21M.301
U (Fall, Spring)
3-2-7 HASS
A continuation of 21M.301, including chromatic harmony and modulation, a more extensive composition project, keyboard laboratory, and musicianship laboratory.
Fall: K. Makan, C. Hughes, S. Cleveland
Spring: C. Shadle, C. Hughes, S. Cleveland

21M.303a Writing in Tonal Forms I
Prereq: 21M.302
U (Fall, Spring)
3-1-8 HASS
Written and analytic exercises based on 18th- and 19th-century small forms and harmonic practice found in music such as the chorale preludes of Bach; minuets and trios of Haydn, Mozart, and Beethoven; and the songs and character pieces of Schubert and Schumann. Musicianship laboratory is required.
Fall: C. Shadle, S. Cleveland
Spring: P. Child, S. Cleveland

21M.304 Writing in Tonal Forms II
Prereq: 21M.303
U (Spring)
3-1-8 HASS
Further written and analytic exercises in tonal music, focusing on larger or more challenging forms. For example, students might compose a sonata-form movement for piano or a two-part invention in the style of Bach. Students have opportunities to write short works that experiment with the expanded tonal techniques of the late 19th and early 20th centuries. Musicianship laboratory is required.
C. Shadle, S. Cleveland

21M.340 Jazz Harmony and Arranging
Prereq: 21M.051, 21M.026 or permission of instructor
U (Spring)
3-0-9 HASS
Basic harmony and theory of mainstream jazz and blues; includes required listening in jazz, writing and analysis work, and two full-scale arrangements. Serves as preparation for more advanced work in jazz with application to rock and pop music. Performance of student arrangements.
_M. Harvey_
Jazz writing using tonal, modal, and extended compositional approaches as applied to the blues, the 32-bar song form, and post-bop structural designs. Consideration given to a variety of styles and to the ways improvisation informs the compositional process. Study of works by Ellington, Mingus, Parker, Russell, Evans, Nelson, Golson, Coleman, Coltrane, Threadgill, Hemphill, and others. Performance of student compositions.

M. Harvey

21M.350 Musical Analysis
Prereq: 21M.302 or permission of instructor
U (Spring)
3-0-9 HASS
An introduction to the analysis of tonal music. Students develop analytical techniques based upon concepts learned in 21M.301–21M.302. Students study rhythm and form, harmony, line and motivic relationships at local and large scale levels of musical structure. Three papers (totaling 20 pages, one to be revised) and one oral presentation required.

P. Child

21M.351 Music Composition
(Subject meets with 21M.505)
Prereq: 21M.304 or permission of instructor
U (Fall, Spring)
3-0-9 HASS
Can be repeated for credit
Directed composition of larger forms of original writing involving voices and/or instruments. Includes a weekly seminar in composition for the presentation and discussion of work in progress. Students are expected to produce at least one substantive work, performed in public, by the end of the term. Contemporary compositions and major works from 20th-century music literature are studied.

Staff

21M.361 Composing with Computers
Prereq: Permission of instructor
U (Fall, Spring)
2-2-8 HASS
A series of composition projects using various types of recording equipment, editing software, audio hardware, and programming environments. Class culminates in a public concert presenting student work. Instruction in recording, editing, synthesis, sampling, digital sound processing, sequencing, and interactive systems. Close listening to computer and electronic music from composers and sound artists including Cage, Eno, Ikeda, Kraftwerk, Lanskij, Radiohead, Stockhausen, Varese and Xenakis. Focus on using the computer as a means of musical creativity and intuition. Enrollment limited to 12, with priority given to Music majors, minors, concentrators, and those with previous compositional experience.

P. Whincop

Performance
Each of the following subjects earns 6 units. A total of 12 units is needed for a subject to count toward Institute Requirements in Humanities, Arts, and Social Sciences, by petition to the COC.

21M.401 MIT Concert Choir
Prereq: —
U (Fall, Spring)
0-4-2
Can be repeated for credit
Rehearsals and performance of primarily large-scale works for chorus, soloists, and orchestra from the Passions and Masses of J. S. Bach to oratorios of our own time. Open to graduate and undergraduate students by audition.

W. Cutter

21M.405 MIT Chamber Chorus
Prereq: —
U (Fall, Spring)
3-0-3
Can be repeated for credit
Rehearsal and performance of choral repertoire for small chorus, involving literature from the Renaissance to contemporary periods. Membership limited to 32 students by audition.

W. Cutter

21M.410 Vocal Repertoire and Performance
(Subject meets with 21M.515)
Prereq: Participation in ensemble for vocalists
U (Spring)
3-0-3
Can be repeated for credit
For the singer and/or pianist interested in collaborative study of solo vocal performance. Historical study of the repertoire includes listening assignments of representative French, German, Italian, and English works as sung by noted vocal artists of the genre. Topics include diction as facilitated by the study of the International Phonetic Alphabet; performance and audition techniques; and study of body awareness and alignment through the Alexander Technique and yoga. Admission by audition. Required for all Emerson Music Vocal Scholars.

P. Wood

21M.421 MIT Symphony
Prereq: —
U (Fall, Spring)
0-4-2
Can be repeated for credit
Rehearsals prepare works for concerts and recordings. Analyses of musical style, structure, and performance practice are integrated into rehearsals as a means of enriching musical conception and the approach to performance. Likewise, additional scores of particular structural or stylistic interest are read whenever time permits. Admission by audition.

A. Boyles

21M.422 MIT String Chamber Orchestra
Prereq: Admission by audition
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall, Spring)
0-2-1
Can be repeated for credit
Music for string chamber orchestra drawn from traditional mainstream pieces of the Baroque, Romantic, and 20th-century with at least one world premiere per year. Admission by audition. One on-campus performance each term.

Staff

21M.423 Conducting and Score-Reading
Prereq: 21M.301, 21M.302
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-4-5 HASS
Introduces orchestral conducting as a discipline combining advanced ear training, musical analysis, practical musicianship, and score-reading skills. Focuses on mainstream repertoire, with emphasis on music performed by the MIT Symphony and String Chamber Orchestras. Rehearsal attendance required. Opportunities to lead sectional rehearsals depending upon level of ability. Audition required.

Staff

21M.426 MIT Wind Ensemble
Prereq: —
U (Fall, Spring)
0-4-2
Can be repeated for credit
Open by audition to advanced instrumentalists who are committed to the analysis, performance, and recording of woodwind, brass, and percussion literature from the Renaissance through the 21st century. The repertoire consists primarily
of music for small and large wind ensembles. May include ensemble music from Gabrieli to Grainger, Schuller, Mozart, Dvorak, and various mixed media including strings. Performance of newly commissioned works. Opportunities for solo work.

F. Harris

21M.442 MIT Festival Jazz Ensemble
Prereq: —
U (Fall, Spring)
0-4-2
Can be repeated for credit
Open by audition to instrumentalists dedicated to the analysis and performance of traditional and contemporary jazz ensemble compositions. Instrumentation includes saxophones, trumpets, trombones, piano, guitar or vibraphone, bass, percussion and occasionally french horn, double reeds, and strings. Experience in improvisation preferred but not required. Opportunities to work with professional jazz artists and perform commissioned works by recognized jazz composers.

F. Harris

21M.445 Chamber Music Society
Prereq: —
U (Fall, Spring)
0-4-2
Can be repeated for credit
Study of chamber music literature through analysis, rehearsal, and performance. Weekly seminars and coaching. Open to string, piano, brass, woodwind players, and singers. By audition.

M. Thompson, D. Deveau, J. Rife, F. Harris

21M.450 MIT Balinese Gamelan
Prereq: Permission of instructor
U (Fall, Spring)
0-3-3
Can be repeated for credit
A performing ensemble dedicated to the traditional music of Bali and East Java. Members of the ensemble rehearse and study techniques on MIT’s three distinctive sets of gamelan instruments and perform in conjunction with Gamelan Galak Tika. No previous experience necessary, but prior enrollment in 21M.030 or 21M.292 is strongly recommended. Enrollment limited to 25 students by audition.

E. Ziporyn

21M.451 Studio Accompanying for Pianists
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit
Open by audition to pianists who wish to explore and develop their talents as accompanists. Pianists are paired with a music scholarship recipient and attend that student’s private lesson each week. Accompanists prepare independently, rehearse with the student partner, and provide accompaniment at a juried recital or masterclass each term. Under supervision for music faculty and private lesson instructors, pianists may work with one or two scholarship students each term at 3 units each or one student in 21M.480/21M.512 for 6 units. Subject satisfies the performance requirement for pianists receiving music scholarships.

D. Deveau

21M.460 MIT Senegalese Drum Ensemble
Prereq: —
U (Fall, Spring)
0-3-3
Can be repeated for credit
A performance ensemble focusing on the sabar drumming tradition of Senegal, West Africa. Study and rehearse Senegalese drumming techniques and spoken word. Perform in conjunction with MIT Rambax drumming group. No previous experience necessary, but prior enrollment in 21M.030 or 21M.293 strongly recommended. Enrollment limited to 20 students by audition.

L. Toure

21M.480 Advanced Music Performance (Subject meets with 21M.512)
Prereq: —
U (Fall, Spring)
1-2-3
Can be repeated for credit
Open by audition to students who demonstrate considerable technical and musical skills and who wish to develop them through intensive private study. Students must take a weekly lesson, attend a regular performance seminar, and participate in a departmental performing group. Full-year commitment required. Information about lesson fees, scholarships, and auditions available in Music Section Office. Meets with 21M.512, but assignments differ.

M. Thompson, D. Deveau

21M.500 Senior Seminar in Music
Prereq: 21M.302 and two 21M.2xx subjects
U (Fall)
3-0-9 HASS
Develop analytic and research skills in music. Focus upon a small number of important works, which are studied in depth. Strong emphasis upon student presentations and discussion, and a substantial writing project.

P. Child

21M.505 Advanced Music Composition (Subject meets with 21M.351)
Prereq: —
G (Fall, Spring)
3-0-9
Can be repeated for credit
Subject meets with 21M.351 but assignments differ.

Staff

21M.512 Advanced Music Performance (Subject meets with 21M.480)
Prereq: —
G (Fall, Spring)
1-2-3
Can be repeated for credit
Meets with 21M.480, but assignments differ.

M. Thompson, D. Deveau

21M.515 Vocal Repertoire and Performance (Subject meets with 21M.410)
Prereq: —
G (Spring)
3-0-3
Can be repeated for credit
Required for all Emerson Music Vocal Scholars. Other admission by audition.

P. Wood

21M.531, 21M.533, 21M.536, 21M.538 Special Topics in Music
Prereq: Any two subjects in Music
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Open to qualified students who wish to pursue special studies or projects with members of the Music Section. Students electing this subject must secure the approval of the chairman of the Music Section. HASS credit for Special Topics subjects awarded only by individual petitions to the Committee on Curricula. Normal maximum is 6 units; to count toward HASS Requirement,
Music and Media

21M.565J Writing for Computer Performance
(Same subject as MAS.642J)
Prereq: MAS.641
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject MAS.642J.
B. Vercoe

21M.566J Audio Processing by People and Machines
(Same subject as MAS.641J)
(Subject meets with MAS.241)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject MAS.641J.
B. Vercoe

21M.570 Computer Music Composition
Prereq: 21M.565J
G (Fall, Spring)
3-6-3 H-LEVEL Grad Credit
Can be repeated for credit
Directed composition of larger forms of original writing using computer-processed sound, to be performed either alone or with voices and/or instruments. Includes a weekly seminar in composition for the examination of major works from 20th-century music literature and for the presentation and discussion of student works in progress. Students expected to produce at least one substantive work to be performed in public by the end of the term. Open to qualified undergraduates.
B. Vercoe

21M.580J Musical Aesthetics and Media Technology
(Same subject as MAS.825J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-3-3 H-LEVEL Grad Credit
See description under subject MAS.825J.
T. Machover

21M.581J Projects in Media and Music
(Same subject as MAS.826J)
Prereq: MAS.825J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-3-6 H-LEVEL Grad Credit
Can be repeated for credit
See description under subject MAS.826J.
T. Machover

THEATER ARTS

The subjects listed below are arranged in three sections: Introductory subjects; Intermediate subjects; and Special Topics/Advanced subjects. For subjects dealing with the literature of the theater, see 21L.009, 21L.422, 21L.486, 21L.703 in Literature.

Introductory Subjects

21M.600 Introduction to Acting
Prereq: —
U (Fall, Spring)
4-0-5 HASS
Explores the actor’s tools: body, voice, mind, imagination, and the essential self. Through studio exercises, students address issues of honesty and creativity in the theatrical moment, and begin to have a sense of their strengths and limitations as communicating theatrical artists. Provides an opportunity for students to discover their relationship to “the other” in the acting partner, the group, the environment, and the audience.
A. Brody, K. Mancuso

21M.604J Playwriting I
(Same subject as 21W.754J)
Prereq: —
U (Fall, Spring)
3-0-9 HASS
Introduces the craft of writing for the theater. Through weekly assignments, in class writing exercises, and work on a sustained piece, students explore scene structure, action, events, voice, and dialogue. Examine produced play scripts and discuss student work. Emphasis on process, risk-taking, and finding one’s own voice and vision.
L. Harrington

21M.605 Voice and Speech for the Actor
Prereq: —
U (Fall, Spring)
4-0-5 HASS
Can be repeated for credit
Concentrates upon freeing the natural voice, culminating in the actor’s ability to work in any style. The progression of Linklater’s approach to voice is taught, as time allows. Although the focus is acting, students not primarily interested in theater but interested in developing their voices may find this class useful.
K. Eastley
21M.606 Introduction to Stagecraft
Prereq: —
U (Spring)
3-3-6 HASS
Introduces students to the variety and scope of stagecraft while they learn basic shop skills. Students develop shop vocabulary and learn safe use of all shop machines, basic handwork skills, names and uses of tools, and an overview of the various activities that go on in each shop. In each production area, students complete a project that uses all basic skills. Students build a final project of choice that relates to the skills that stagecraft covers.

Rinaldi Staff

21M.611 Foundations of Theater Practice
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-3-6 HASS-D, Category 3
Introduces the ideas, skills, and aesthetic issues which comprise the creation of the theatrical event. Guest artists and faculty members introduce the work of different disciplines such as directing, stagecraft, design, acting, dramaturgy, and criticism. Readings, in-class exercises, and scheduled work in design and/or performance studios help students understand and experience the basic creative impulse in each area. Each student develops a portfolio of analysis and research.

J. Scheib

21M.616 Learning from the Past: Performance, Drama, Science
(Subject meets with 21L.016)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 3, CI-H
Explores the creation (and creativity) of the modern scientific and cultural world through study of western Europe in the 17th century, the age of Descartes and Newton, Shakespeare, Rembrandt and Molière. Compares period thinking to present-day debates about the scientific method, art, religion, and society. This team-taught, interdisciplinary subject draws on a wide range of literary, dramatic, historical, and scientific texts and images, and involves theatrical experimentation as well as reading, writing, researching and conversing. Meets most of the time with 21L.016, but differs from it by analyzing theatrical texts.

J. Sonenberg

21M.621J Theater and Cultural Diversity in the US
(Same subject as SP.595J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 3
Explores contemporary American theatrical expression around issues of gender, ethnic, and cultural identities. Analyzes performances, scripts, video documentation, and invention of original documents of theatrical expression, and construction of gender within particular formations of American culture. Class lectures and discussions analyze samples of Native American, Chicano, African American, and Asian American theater, considering the historical and political context for the creation of these works. Performance exercises help identify theatrical forms used by these theaters and consider how these techniques contribute to the overall goals of specific theatrical expressions.

T. DeFrantz

21M.645 Composition for Stage and Performance
Prereq: 21M.600 or permission of instructor
U (Fall)
4-2-3 HASS
Examines the theatrical event from the perspective of composition in a performance workshop. Studio exercises address the process of developing a theatrical work through an internalized understanding of compositional principles in theater. Examines uses of time, space, and action. Complemented by outside readings, videos, short essays, and in-class discussions, subject provides performer, director, choreographer, designer or writer opportunities to engage with large and small group ensembles in creation of theatrical events. Topics include image, movement, shape, repetition, gesture, and spatial relationship.

J. Scheib

21M.670J Traditions in American Concert Dance: Gender and Autobiography
(Same subject as SP.591J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 3, CI-H
Explores forms, content, and contexts of world traditions in dance that played a crucial role in shaping American concert dance with attention to issues of gender and autobiography. Explores artistic lives of dance artists Katherine Dunham, Alvin Alley, Isadora Duncan, Martha Graham, and George Balanchine as American dance innovators. Lectures and discussions analyze these artists’ works, taking into consideration historical and political contexts. Viewing assignments and attendance of Boston-area dance performances help students identify visual, musical, and kinesthetic underpinnings of choreographic structure.

T. DeFrantz

21M.675 Dance Theory and Composition
Prereq: 21M.600 or permission of instructor
U (Fall)
4-0-5 HASS
Explores aesthetic and technical underpinnings of contemporary dance composition. Basic compositional techniques discussed and practiced with an emphasis on principles such as weight, space, time, effort, and shape. Principles of musicality considered and developed by each student. Working together, students create short compositions to help them understand the range of possibilities available when working with the medium of the human body. Selected viewing and reading exercises augment classroom work. Class attends at least two professional dance events in the Boston area.

Staff

Intermediate Subjects

21M.704 Musical Theater Workshop
Prereq: 21M.600 or previous experience in musical theater
U (Spring)
4-0-5 HASS
Introduces students to the art and technique of musical theater performance. Movement, singing, and acting are explored during the term, with a focus on the use of the body as an expressive tool. Students develop an understanding of how musicals are composed and the nature of the actor’s contribution to this dynamic form.

T. DeFrantz

21M.705 The Actor and the Text
Prereq: 21M.600 or permission of instructor
U (Fall, Spring)
4-0-5 HASS
Can be repeated for credit
Gives students who have begun the process of bringing themselves to a dramatic moment the opportunity to apply their skills to scripted material. Studio work in this class further develops the completeness, spontaneity, and honesty of expression of the actor’s body, imagination, and voice; and introduces written material and the problems of synthesizing the self, the moment, and the scripted word. Weekly rehearsals with a scene partner.

M. Ouellette
**21M.707 Theater and Collective Creation**  
Prereq: 21M.600 or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
4-0-5 HASS  
Can be repeated for credit  
Explores the process of creating theatrical events through group work and collective creation methodologies. Study of the collective creation techniques of internationally renowned theater groups. Students create original performance works born of their own ideas, concerns, feelings, and motivations.  
*Staff*

**21M.710 Script Analysis**  
Prereq: —  
U (Fall)  
3-0-9 HASS, CI-H  
Focuses on reading a script theatrically with a view to mounting a coherent production. Through careful, intensive reading of a variety of plays from different periods and different aesthetics, a pattern emerges for discerning what options exist for interpreting a script. Students discuss the consequences of those options for production. Enrollment limited.  
*M. Ouellette*

**21M.711 Production Seminar**  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
3-0-6 HASS  
Pursues detailed study of a particular playtext or theme and is related to some planned production activity during the following IAP. Seminar activities may include guest speakers from various disciplines who approach some aspect of the playtext or theme from the perspective of their fields; various theatrical practitioners; and critical and scholarly presentations by seminar members. Participation in the IAP production is not required.  
*Staff*

**21M.712 African-American Performance**  
Prereq: —  
U (Spring)  
4-0-8 HASS  
Surveys black modes of performance. Investigates the musicality, movement styles, and structures of oratory central to African-American life. Explores storytelling, tall tales and snapping, the blues aesthetic and soul, minstrelsy and social dance through the prism of plays written by African-American writers. Examines the participatory, communal essence of black performance and how that performance functions as cultural inspiration, as political weaponry, as art, as religion, and as an entertaining social safety valve. Required readings, written essays, and midterm writing project in addition to creation of short performance pieces.  
*T. DeFrantz*

**21M.713 Selected Studies in Theater**  
Prereq: —  
U (Fall)  
3-0-9 HASS  
Focuses on specific non-European or North American theater, its practice, and theory. A term’s work may center on the theater of a particular culture such as Asia, Africa, Latin America, or particular theater forms such as feminist, Afro-American, Latino, and gay and lesbian.  
*A. Brody*

**21M.714 Selected Topics in Theater Arts**  
Prereq: —  
U (Fall, Spring)  
Units arranged  
Can be repeated for credit  
Provides opportunity for study of topics in theater arts not covered by the regular subject listings, particularly experimental subjects offered by permanent and visiting faculty.  
*Consult Theater Arts Office*

**21M.715 Topics in Technical Theater Design Exploration (New)**  
Prereq: Permission of instructor  
U (Fall, Spring)  
Units arranged  
Can be repeated for credit  
Provides opportunity for study of theater design or technical topics not covered by the regular subject listings. Experimental subjects, advanced design exploration, advanced craft techniques such as structural design for the stage, or specialty costume designs like chainmail or hat construction.  
*Theater Arts Faculty*

**21M.732 Costume Design for the Theater**  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
3-3-6 HASS  
Provides an intermediate workshop designed for students who have a basic understanding of the principles of theatrical design and who want a more intensive study of costume design and the psychology of clothing. Students develop designs that emerge through a process of character analysis, based on the script and directorial concept. Period research, design, and rendering skills are fostered through practical exercises. Instruction in basic costume construction, including drafting and draping, provide tools for students to produce final projects.  
*M. Katz*

**21M.733 Design for the Theater: Scenery**  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-3-6 HASS  
Examines theory of scenic design as currently practiced and alternate traditions in other cultures and eras. Four play scripts and one opera or dance theater piece are designed after being analyzed in depth, exploring their internal workings and relationship to the social, political, artistic, and cultural milieu of their era of creation, and to the current audience. Encourages students to work in a variety of two- and three-dimensional media in developing their ideas.  
*Staff*

**21M.734 Lighting Design for the Theater**  
Prereq: Permission of instructor  
Acad Year 2007–2008: U (Fall)  
Acad Year 2008–2009: Not offered  
3-3-3 HASS  
Explores artistry of lighting design. Students gain overall technical working knowledge of tools and apply it to final design. Stresses artistic, conceptual, and collaborative side of the craft utilizing a hands-on format. Students take advantage of greater Boston venues with backstage tours of various theaters to see how architecture affects lighting design choices. Small projects assigned during term. Final project involves execution of fully realized production, frequently for the Dance Theater Ensemble’s winter concert.  
*K. Perlow*

**21M.735 Technical Design: Scenery, Mechanisms, and Special Effects**  
Prereq: 21M.606 or permission of instructor  
Acad Year 2007–2008: U (Spring)  
Acad Year 2008–2009: Not offered  
3-3-6 HASS  
Looks at special structural and artistic challenges of theatrical scenery, effects, and construction needs. Explores the technical design process and emphasizes safety, budgeting, and problem solving. Work includes actual production assignments and paper design projects. Final project required to explore each student’s specific interests.  
*M. Katz*
21M.775 Hip-Hop
Prereq: —
U (Fall)
3-3-6 HASS

Explores the political and aesthetic foundations of hip-hop. Students trace the musical, corporeal, visual, spoken word, and literary manifestations of hip-hop over its 30-year presence in the American cultural imagery. Students also investigate specific black cultural practices that have given rise to its various idioms. Students create material culture related to each thematic section of the course. Scheduled work in performance studio helps students understand how hip-hop is created and assessed.
A. Brody

21M.785J Playwrights’ Workshop
(Same subject as 21M.785J)
(Subject meets with 21M.789)
Prereq: 21M.604, 21W.754 or permission of instructor
U (Spring)
3-2-7 HASS
Can be repeated for credit

Continues work in the development of play scripts for the theater. Writers work on sustained pieces in weekly workshop meetings, individual consultation with the instructor, and in collaboration with student actors, directors, and designers. Fully developed scripts eligible for inclusion in the Playwrights’ Workshop production.
A. Brody

21M.789 Playwrights’ Workshop
(Subject meets with 21M.785J, 21W.769J)
Prereq: 21M.604, 21W.754 or permission of instructor
G (Spring)
3-2-7
Can be repeated for credit

Meets with 21M.785J but assignments differ.
A. Brody

21M.790 The Director’s Craft
(Subject meets with 21M.791)
Prereq: 21M.600 and 21M.710 or permission of instructor
U (Fall)
4-0-5 HASS

Explores several models of directing, each with its unique structures, philosophy, terminology, and techniques. Exploration is intended to lead to the development of an individual voice for each student and clarity in his/her directorial point of view. Class sessions concentrate on how a point of view is arrived at through analysis of material and the way the results are rendered with the basic tools of theater. All points of view are honored as long as they can be actively supported by the work.
J. Sonenberg

21M.791 The Director’s Craft
(Subject meets with 21M.790)
Prereq: 21M.600 and 21M.710 or permission of instructor
G (Fall)
4-0-5
See description under subject 21M.790.
J. Sonenberg

Special Advanced Topics and Practica

21M.805 Theater Practicum
Prereq: At least one studio subject or permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

Provides directed practice in acting or directing on a sustained theater piece, either one-act or full-length, from pre-rehearsal preparation to workshop production. Consult Theater Arts Office.
Staff

21M.820 Technical Theater Special Topics
Prereq: At least one Theater Arts subject or permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit

Provides opportunity to study theater design and technical production subjects including technical theater practica or experimental subjects offered by the permanent or visiting faculty.
Staff

21M.830 Acting: Techniques and Style
(Subject meets with 21M.835)
Prereq: 21M.600 and 21M.705
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
4-0-8 HASS
Can be repeated for credit

Refines the student actor’s use of the language of the stage with work on text and physical presentation. Explores issues of style, including the understanding and honoring, in performance, of the specific requirements of texts from several different historical periods of the Western theatrical tradition. Periods may differ from term to term.
M. Ouellette

21M.835 Acting: Techniques and Style
(Subject meets with 21M.830)
Prereq: 21M.600 and 21M.705
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
4-0-8
Can be repeated for credit

Meets with 21M.830 but assignments differ. Graduate students are expected to complete additional assignments.
M. Ouellette

21M.840 Performance Media
(Subject meets with 21M.841)
Prereq: —
U (Spring)
4-2-6 HASS

Integrates media and communication technologies in performing arts. Studio exercises provide a forum for experimentation. Contemporary and historical techniques for media integration examined through readings, viewing videos and short written essays. Technologies examined include digital imaging, composite and live feed digital video, and web-based performance. Engages the designer, director, choreographer, performer, visual artist or programmer in the practice of integrating media into live art events. Equipment, where necessary, is provided.
J. Scheib

21M.841 Performance Media
(Subject meets with 21M.840)
Prereq: —
G (Spring)
4-2-6

Meets with 21M.840 but assignments differ. Graduate students are expected to complete additional assignments. See description under 21M.840.
J. Scheib

21M.846 Topics in Performance Studies
(Subject meets with 21M.847)
Prereq: —
U (Spring)
3-2-7 HASS
Can be repeated for credit

Multidisciplinary lecture/workshop engages students in a variety of approaches to the study and practice of performance as an area of aesthetic and social interaction. Special attention paid to the use of diverse media in performance. Interdisciplinary approaches to study encourage
students to seek out material histories of performance and practice. New topics are discussed each year.
T. DeFrantz

21M.847 Topics in Performance Studies
(Subject meets with 21M.846)
Prereq: —
G (Spring)
3-2-7
Can be repeated for credit
See description under 21M.846. Assignments differ.
T. DeFrantz

21M.851 Special Topics in Drama
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
21M.852 Special Topics in Drama
Prereq: Permission of instructor
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Allows students to pursue topics of interest as independent study. Enrollment requires approval of the director of Theater Arts. HASS credit for Special Topics subjects awarded only by individual petitions to the Committee on Curricula. Normal maximum is 6 units; to count toward HASS Requirement, 9 units are required. Exceptional 9-unit projects occasionally approved.
Consult Theater Arts Office

21M.863 Advanced Topics in Theater Arts
Prereq: Any two subjects in Theater Arts or permission of instructor
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Gives opportunity for advanced study in theater arts not covered by the regular subject listings. Includes experimental subjects offered by permanent and visiting faculty. Students seeking an individual program of study with a particular faculty member must also obtain the approval of the director of Theater Arts. Consult Theater Arts Office for departmental form.
Consult Theater Arts Office

21M.864 Theater Studies
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Provides opportunity for the study of theatrical topics not covered in the regular curriculum, particularly experimental subjects offered by faculty or visiting faculty.
Consult Theater Arts Office

21M.865 Research in Theater
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged
Can be repeated for credit with permission of instructor
Offers directed research of advanced theatrical subjects occurring in either the performance or theoretical spheres.
Consult Theater Arts Office

21M.873 IAP Theater Arts Topics
Prereq: Permission of instructor
U (IAP)
Units arranged
Provides opportunity for the study of theater arts topics not covered by regular subject listings, including experimental subjects offered by permanent and visiting faculty. Students seeking an individual program of study with a faculty member must also obtain the approval of the director of Theater Arts. Consult Theater Arts office for departmental form.
Staff

21M.880 Dance Production
(Subject meets with 21M.881)
Prereq: —
U (Fall, Spring)
0-4-2
Can be repeated for credit
21M.881 Dance Production
(Subject meets with 21M.880)
Prereq: —
G (Fall, Spring)
0-4-2
Can be repeated for credit
Prepares students in rehearsals for concert performance of original dance works in various idioms, focusing on expressive elegance and the creative process. Open to students by audition.
Meets with 21M.880 but assignments differ.
Staff

21M.ThT Music Pre-Thesis Tutorial
Prereq: Music major status
U (Fall, Spring)
1-0-5
Can be repeated for credit
Definition of and early-stage work on thesis project leading to 21M.ThT Undergraduate Thesis in Music. Taken during the first term of the student’s two-term commitment to the thesis project. Student works closely with an individual faculty tutor.
Consult D. K. Fitzgerald

21M.ThU Undergraduate Thesis in Music
Prereq: 21M.ThT
U (Fall, Spring)
Units arranged
Can be repeated for credit
Completion of work on senior major thesis under supervision of a faculty tutor. Includes oral presentation of thesis progress early in the term, assembling and revising final text, and meeting at the close with a committee of faculty evaluators to discuss successes and limitations of the project.
Consult D. K. Fitzgerald

21M.UR Research in Music
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
21M.URG Research in Music
U (Fall, Spring)
Units arranged
Can be repeated for credit
Individual participation in an ongoing music research project. For students in the Undergraduate Research Opportunities Program.
Consult D. K. Fitzgerald

Note that thesis is not a requirement of the Music program.

Theater Arts students are required to produce a thesis. Since their programs are major departures in the School of Humanities, Arts, and Social Sciences, they should register for 21M.ThT and 21M.ThU. They should also register for 21M.UR or 21M.URG when doing UROP projects. Descriptions of these subjects can be found in Course 21.
The Program in Writing and Humanistic Studies has four undergraduate subject areas:

1) Exposition and Rhetoric
2) Creative Writing
3) Science Writing
4) Technical Communication and New Media Studies

Each area has introductory and advanced subjects. Introductory subjects are designed for beginning college writers; advanced subjects are designed to develop greater competence in one or more special forms of writing.

INTRODUCTORY

21W.730 Writing on Contemporary Issues
Prereq: —
U (Fall, Spring)
3-0-9 HASS, CI-HW

Focuses on forms of exposition, including narration, critique, argument, and persuasion, to develop students’ ability to write clear and effective prose. Students write frequently, receive feedback on work in progress, improve their work by revising, read the work of accomplished writers, and participate actively in class discussions and workshops. Short oral presentations also required. Readings and assignments vary by section and focus on themes such as contemporary social problems, the cultural influence of film, the culture of food, the environment, and others. See subject website for complete section descriptions. Enrollment limited.

21W.731 Writing and Experience
Prereq: —
U (Fall, Spring)
3-0-9 HASS, CI-HW

Focuses on the ways writers transform experience into finished and polished writing in the forms of memoir, autobiography, and essay. Frequent writing assignments, regular revisions, and short oral presentations required. Readings and specific writing assignments vary by section. The subject website for enhanced section descriptions. Emphasizes developing students’ ability to write clear and effective prose.

EXPOSITION AND RHETORIC

Introductory

See subjects 21W.730 and 21W.734J.

21W.732 Introduction to Technical Communication
Prereq: —
U (Fall, Spring)
3-0-9 HASS, CI-HW

Focuses on various forms of technical and scientific writing, including special problems in organizing and presenting technical information and writing for different audiences and purposes. Frequent writing assignments, regular revisions, and short oral presentations required. Readings and specific writing assignments vary by section. See subject website for enhanced section descriptions. Emphasizes developing students’ ability to write clear and effective prose. Students write frequently, give and receive response to work in progress, improve their writing by revising, read the work of accomplished writers, and participate actively in class discussions and workshops. Enrollment limited.

21W.734J Writing About Literature
(Same subject as 21L.000)
Prereq: —
U (Fall, Spring)
3-0-9 HASS, CI-HW

See description under subject 21L.000. Fall: W. Kelley

Spring: Staff

21W.735 Writing and Reading the Essay
Prereq: 21W.730, or excellent writing sample and permission of instructor
U (Fall, Spring)
3-0-9 HASS-D, Category 1, CI-H

Exploration of formal and informal modes of writing nonfiction prose. Extensive practice in composition, revision, and editing. Reading in the literature of the essay from the Renaissance to the present, with an emphasis on modern writers. Classes alternate between discussion of published readings and workshops on student work. Individual conferences.

21W.736 News Writing
Prereq: —
U (Fall)
3-0-9 HASS

An introduction to the basics of print journalism, including an overview of journalistic ethics and life in the newsroom. Students learn basic reporting techniques, interviewing, and news writing, with an emphasis on accuracy, clarity, and brevity. Most writing done in class whereby students learn to write under time pressure, as well as in a distracting environment. Techniques of investigative reporting—including interviewing and research into public and private sources—are assigned on a weekly basis for outside classroom work.

B. D. Colen

21W.739 Darwin and Design
(Same subject as 21L.448J)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 2, CI-H

See description under subject 21L.448J. A. Kibel, J. Paradis

21W.740 Writing Autobiography and Biography
Prereq: —
U (Spring)
3-0-9 HASS

Writing an autobiography is a vehicle for improving one’s style while studying the nuances of the language. Literary works are read with an
emphasizes on different forms of autobiography. Students examine various stages of life, significant transitions, personal struggles, and memories translated into narrative prose, and discuss: what it means for autobiographer and biographer to develop a personal voice; and the problems of reality and fiction in autobiography and biography.

K. Manning

21W.742 Writing About Race
(Subject as SP.575)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H

The issue of race and racial identity have preoccupied many writers throughout the history of the US. Students read Toni Morrison, James Baldwin, Louise Erdrich, William Faulkner, Maxine Hong Kingston, Sandra Cisneros, and Judson Mitcham, and consider the story of race in its peculiarly American dimensions. The reading, along with the writing of members of the class, is the focus of class discussions. Oral presentations on subjects of individual interest are also part of the class activities. Students explore race and ethnicity in personal essays, pieces of cultural criticism or analysis, or (with permission of instructor) fiction. All written work is read and responded to in class workshops and subsequently revised. Enrollment limited.

S. King

21W.745 Advanced Essay Workshop
(Subject meets with SP.576)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS, CI-H
Can be repeated for credit

For students with experience in writing essays and nonfiction prose. Focuses on negotiating and representing identities grounded in gender, race, class, nationality, and sexuality in prose that is expository, exploratory, investigative, persuasive, lyrical, or incantatory. Authors include James Baldwin, Minnie Bruce Pratt, Audre Lorde, Richard Rodriguez, Alice Walker, John Edgar Wideman, Diana Hume George, bell hooks, Margaret Atwood, Patricia J. Williams, and others. Designed to help students build upon their strengths as writers and to expand their repertoire of styles and approaches in essay writing.

J. Diaz

21W.746 Humanistic Perspectives on Medicine: From Ancient Greece to Modern America
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5, CI-H

For students with experience in nonfiction prose and interest in the non-science side of medicine. Advanced study of the art of essay (form, style, techniques of persuasion) and practice of that form. Students required to write substantial essays and revise their work. Students read and discuss the writings of distinguished physicians from antiquity to the late 20th century.

W. Haas

21W.747 Rhetoric
Prereq: —
U (Fall, Spring)
3-0-9 HASS-D, Category 2, CI-H

For students with a special interest in learning how to make forceful arguments in written form. Studies the forms and structures of argumentation, including organization of ideas, awareness of audience, methods of persuasion, evidence, factual vs. emotional argument, figures of speech, and historical forms and uses of arguments. Fall: S. Strang, M. Poe, L. Perelman
Spring: S. Strang, L. Perelman

21W.748 Writing about the Culture of Medicine (New)
(Subject meets with HST.960)
Prereq: —
U (Spring)
3-0-9 HASS

Open to students interested in medicine’s impact on American culture and the American public’s attitude toward medical practice. Designed to improve writing, editing, and analytic skills by writing creatively about the culture of medicine and presenting a new piece of prose every other week. Readings include short works by great thinkers and up-to-the-minute political and cultural articles on medical science and practice. Student evaluations based on final version of creative work. Workshop format; meets at Harvard Medical School.

S. Klingenstei

21W.754 Playwriting I
(Subject as 21M.604J)
Prereq: —
U (Fall, Spring)
3-0-9 HASS

See description under subject 21M.604J.

L. Harrington

21W.755 Writing and Reading Short Stories
Prereq: —
U (Fall, Spring)
3-0-9 HASS

Introduction to the short story. Students write stories and short descriptive sketches. Readings from European and American stories from the 18th, 19th, and 20th centuries. Class discussion of students’ writing and of the assigned stories in their historical and social contexts.

R. Lombreglia, S. Lewitt

21W.756 Writing and Reading Poems
Prereq: —
U (Fall, Spring)
3-0-9 HASS

Examination of the formal structural and textual variety in poetry. Extensive practice in the making of poems and the analysis of both students’ manuscripts and texts from 16th- through 20th-century literature. Attempts to make relevant the traditional elements of poetry and their contemporary alternatives. Weekly writing assignments, including some exercises in prosody.

W. Corbett
Part 608
21W.757 Fiction Workshop
Prereq: 21W.755
U (Fall, Spring)
3-0-9 HASS
Can be repeated for credit

For students interested in developing their understanding of the craft of fiction. Weekly workshop discussions of students’ work focus on analysis of structure, style, and characterization. Emphasis on editing and revision. Reading and discussion of 19th- and 20th-century authors, such as Babel, Carver, Chekhov, Faulkner, Kafka, Orwell, Marquez, and Woolf.

Fall: H. Lee, A. Castillo
Spring: R. Lombreglia

21W.758 Genre Fiction Workshop
Prereq: A subject in writing short fiction or comparable writing experience
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Students read across genres about war and peace, and write stories in a specific genre, although not necessarily about the reading topic. Readings include The Art of War, Sun Tzu; The Vintage Book of War Fiction; Master and Commander, Patrick O’Brien; Starship Troopers, Robert Heinlein; The Dispossessed, Ursula LeGuin; Soldier of the Mist, Gene Wolfe; and The Things They Carried, Tim O’Brien. Students write a short reaction to each novel. Studies genre and freedoms associated with each genre. Students write a short story within a genre or between genres for round-table workshop discussions of students’ work. Emphasis on writing short stories within a genre or between genres for round-table workshopping. Enrollments limited to 15 students.

J. Holdeman

21W.759 Writing Science Fiction
Prereq: —
U (Fall)
3-0-9 HASS

Students write and read science fiction and analyze and discuss stories written for the class. For the first eight weeks, readings in contemporary science fiction accompany lectures and formal writing assignments intended to illuminate various aspects of writing craft as well as the particular problems of writing science fiction. The rest of the term is given to roundtable workshops on students’ stories.

J. Holdeman

21W.762 Poetry Workshop
Prereq: —
U (Fall)
3-0-9 HASS
Can be repeated for credit

For students with some previous experience in poetry writing. Frequent assignments stress use of language, diction, word choice, line breaks, imagery, mood, and tone. Considers the functions of memory, imagination, dreams, poetic impulses. Throughout the term, students examine the work of published poets. Revision stressed.

Staff

21W.765 Interactive and Non-Linear Narrative: Theory and Practice
(Same subject as 21L.489J)
(Subject meets with CMS.845)
Prereq: —
U (Fall)
3-0-9 HASS

Techniques of creating narratives that take advantage of the flexibility of form offered by the computer. Study of the structural properties of book-based narratives that experiment with digression, multiple points of view, disruptions of time and of storyline. Analysis of the structure and evaluation of the literary qualities of computer-based narratives including hypertexts, adventure games, and classic artificial intelligence programs like Eliza. With this base, students use authoring systems to model a variety of narrative techniques and to create their own fictions. Knowledge of programming helpful but not necessary.

E. Barrett

21W.766 Contemporary US Women of Color: Writing and Reading Short Stories
(Same subject as SP.574J)
Prereq: —
U (Spring)
3-0-9 HASS

Students read short stories by Native American, Latina, African-American, and Asian-American women writers and write their own stories and descriptive sketches. Writing assignments and discussions focus on these themes: reclaiming, reconstructing, and preserving culture; cultural heritage as a source of power and resistance; storytelling as a means of celebration and survival; shifting, contending, and multiple identities; the costs and advantages of breaking silence; and tensions between assimilation and maintaining cultural practices.

H. Lee

21W.769 Playwrights’ Workshop
(Same subject as 21M.785J)
(Subject meets with 21M.789)
Prereq: 21M.604, 21W.754 or permission of instructor
U (Spring)
3-2-7 HASS
Can be repeated for credit

See description under subject 21M.785J.

A. Brody

21W.770 Advanced Fiction Workshop
Prereq: Permission of instructor
U (Fall, Spring)
3-0-9 HASS
Can be repeated for credit

For students with some experience in writing fiction. Write longer works of fiction and short stories which are related or interconnected. Read short story collections by individual writers, such as Sandra Cisneros, Raymond Carver, Edward P. Jones, and Tillie Olsen, and discuss them critically and analytically, with attention to the ways in which the writers’ choices about component parts contribute to meaning. In-class exercises and weekly workshops of student work focus on sources of story material, characterization, structure, narrative voice, point of view and concrete detail. Concentration on revision.

H. Lee

21W.771 Advanced Poetry Workshop
Prereq: Prior manuscript submission required
U (Spring)
3-0-9 HASS
Can be repeated for credit

For students experienced in writing poems. Regular reading of published contemporary poets and weekly submission of manuscripts for class review and criticism. Students expected to do a substantial amount of rewriting and revision. Classwork supplemented with individual conferences.

Staff

21W.772 Digital Poetry
Prereq: —
U (Fall)
3-0-9 HASS

Digital forms of poetry, including hypertext poems, Flash-animated poems, poems within short digital videos and interactive forms of poetry and games. Readings in early hypertext theory and creative writing. Experiment with creating poetry for wireless access on handheld devices. Test the assumptions of these early theorists through practice of creating digital poetry. Students discuss online examples of each of
these kinds of digital poetry and then compose their own work, to present in class for critique and revision. The final project allows students to build upon their experience throughout the term with these forms. 

E. Barrett

21W.773 Writing Longer Fiction
Prereq: A fiction workshop or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

Designed for students who have some experience in writing fiction and want to try longer forms like the novella and novel. Students interested in writing a novel are expected to produce at least two chapters and an outline of the complete work. Readings include several novels from Fitzgerald to the present, and novellas from Gogol’s The Overcoat to current examples. Students discuss one another’s writing in a roundtable workshop, with a strong emphasis on revision.

J. Holdeman

21W.775 Writing about Nature and Environmental Issues
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 1, CI-H

Focuses on traditional nature writing and the environmentalist essay. Students keep a web log as a journal. Writings are drawn from the tradition of nature writing and from contemporary forms of the environmentalist essay. Authors include Henry Thoreau, Loren Eiseley, Annie Dillard, Chet Raymo, Sue Hubbel, Rachel Carson, Bill McKibben, and Terry Tempest Williams.

K. Boiko

SCIENCE WRITING

Introductory

See subject 21W.732.

Advanced

21W.777 The Science Essay
Prereq: —
U (Spring)
3-0-9 HASS

Drawing in part from their own interests and ideas, students write about science within various cultural contexts. Students employ a broad repertoire of literary tools, such as narrative, scene-setting, and attention to larger issues of structure. Students study the work of science writers such as Alan Lightman, Oliver Sacks and Malcolm Gladwell to help them create essays of substance and grace that have science and technology as their subjects. Not a technical writing class.

K. Boiko

21W.778 Science Journalism
Prereq: —
U (Fall)
3-0-9 HASS, CI-H

An introduction to print daily journalism and news writing, focusing on science news writing in general, and medical writing in particular. Emphasis is on writing clearly and accurately under deadline pressure. Class discussions involve the realities of modern journalism, how newsrooms function, and the science news coverage in daily publications. Discussions of, and practice in, interviewing and various modes of reporting. In class, students write numerous science news stories on deadline. There are additional longer writing assignments outside of class. Enrollment limited.

T. Levenson

See subjects 21W.792, 21W.820J.

TECHNICAL COMMUNICATION AND NEW MEDIA STUDIES

Introductory

See subject 21W.732.

Advanced

21W.780 Communicating in Technical Organizations
Prereq: —
U (Spring)
3-0-9 HASS, CI-H, Phase Two WRIT

An exploration of the role that communication plays in the work of the contemporary engineering and science professional. Emphasis is placed on analyzing how composition and publication contribute to work management and knowledge production, as well as the how-to aspects of writing specific kinds of documents in a clear style. Topics include communication as organizational process, electronic modes such as e-mail and the Internet, the informational and social roles of specific document forms, writing as collaboration, the writing process, the elements of style, methods of oral presentation, and communication ethics. Case studies used as the basis for class discussion and some writing assignments. Several short documents, a longer report or article, and a short oral presentation are required.

Staff

21W.781J Communicating About Technology: Colossal Failures in Engineering
(Same subject as 1.588J, 3.070J, 22.002J, ESD.032J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H

Explores communication about technological subjects in the context of colossal engineering failures including Three Mile Island, Bhopal, the Columbia Shuttle, 9/11, and Katrina. Examines the basic engineering principles and the social context of several such failures in case studies from various engineering disciplines. Students see how problematic communications, sometimes subtly unrecognized at the time, significantly contributed to the final failures. Students collaborate to produce a final written and oral research report that anticipates a potential failure and makes recommendations for avoiding it. Multiple sections, each limited to 18 students.

T. Eagar, W. Haas, A. Kadak, P. Lagacé

21W.782J Principles and Practice of Science Communication
(Same subject as STS.014J)
Prereq: —
U (Spring)
3-0-9 HASS

See description under subject STS.014J.

J. Durant

21W.784 Becoming Digital: Writing about Media Change
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 4, CI-H

Compares pre-digital to digital media to explore the unique problems that arise in this transition, including the manipulability of digital images, the ethics of anonymity on the Internet, the social repercussions of the computer, and the allure of computer gaming. Readings include subject-specific texts, augmented by philosophical articles relevant to the course themes, and some film. Frequent writing and revision, an oral presentation, and intensive class participation are required. Enrollment limited to 18.

B. Miller
21W.785 Communicating in Cyberspace
Prereq: —
U (Fall, Spring)
3-0-9 HASS, CI-H

Analysis, design, implementation, and testing of various forms of digital communication based on group collaboration. Students are encouraged to think about the Web and other new digital interactive media not just in terms of technology but also broader issues such as language (verbal and visual), design, information architecture, communication and community. Students work in small groups on a term-long project of their choice. Various written and oral presentations document project development.

Fall: E. Barrett
Spring: N. Montfort

21W.792 Science Writing and Technical Communication Internship
Prereq: 21W.778 or 21W.780
U (Spring)
0-12-0 HASS
Can be repeated for credit

Part-time internships in Boston-area media and industries are arranged for students wishing to develop professional writing and publishing skills. Students planning to take this subject must contact the instructor by November of the previous term.

J. Paradis

21W.794 Graduate Technical Writing Workshop
Prereq: —
G (IAP, Spring)
Units arranged

Draft a thesis proposal, thesis chapter, journal article, progress report, or specification, and review basics of engineering writing. Sessions cover the processes of organizing and drafting professional papers, improving writing style, and revising documents. Students determine own projects; each project increment receives instructor’s editorial suggestions.

Spring: W. Haas

21W.797 Communication Workshop for CME
Prereq: Acceptance in the CME program
U (Fall)
1-0-1 [P/D/F]

Communication intensive subject for MIT undergraduates participating in the Cambridge-MIT exchange. Intensive week-long workshop focuses on written communication, including discipline-specific material and library research, and emphasizes argumentation skills.

M. Poe

21W.798, 21W.799 Special Topics in Writing
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit

Primarily for students pursuing advanced writing projects with the assistance of a member of the Writing Program. Students electing this subject must secure the approval of the director of the Writing Program and its Committee on Curriculum. HASS credit for Special Topics subjects awarded only by individual petitions to the Committee on Curricula. Normal maximum is 6 units; to count toward HASS Requirement, 9 units are required. Exceptional 9-unit projects occasionally approved. 21W.798 is P/D/F.

J. Paradis

21W.ThT Writing and Humanistic Studies Pre-Thesis Tutorial
Prereq: —
U (Fall, Spring)
1-0-5

Definition of and early stage work on a thesis project leading to 21W.ThU. Taken during the first term of a student’s two-term commitment to the thesis project. Student works closely with an individual faculty tutor. Required of all students pursuing a full major in Course 21W. Joint majors register for 21.ThT.

Staff

21W.ThU Writing and Humanistic Studies Thesis
Prereq: 21W.ThT
U (Fall, Spring)
Units arranged
Can be repeated for credit

Completion of work on the senior major thesis under the supervision of a faculty tutor. Includes oral presentation of the thesis progress early in the term, assembling and revising the final text, and a final meeting with a committee of faculty evaluators to discuss the successes and limitations of the project. Required of students pursuing a full major in Course 21W. Joint majors register for 21.ThU.

Staff

21W.UR Research in Writing and Humanistic Studies
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

21W.URG Research in Writing and Humanistic Studies
U (Fall, Spring)
Units arranged
Can be repeated for credit

Individual participation in an ongoing research project. For students in the Undergraduate Research Opportunities Program.

J. Paradis

Graduate Subjects

21W.820j Writing: Science, Technology, and Society
(Same subject as STS.477J)
Prereq: STS.210J/21H.991J
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject STS.477J.

K. Manning

21W.825 Advanced Science Writing Seminar I
Prereq: Permission of instructor
G (Fall)
6-0-18 H-LEVEL Grad Credit

First term of year-long graduate sequence in science writing offers students intensive workshops and critiques of their own writing, and that of published books, articles, and essays; discussions of ethical and professional issues; study of science and scientists in historical and social context; analysis of recent events in science and technology. Emphasis throughout on developing skills and habits of mind that enable the science writer to tackle scientifically formidable material and write about it for ordinary readers. Topics include the tools of research, conceived in its broadest sense— including interviewing, websites, archives, scientific journal articles; science journalism, including culture of the newsroom and magazine-style journalism; science essays. Considerable attention to science writing’s audiences, markets, and publics and the special requirements of each.

R. Kanigel, M. Bartusiak, T. Levenson, Staff
21W.826 Advanced Science Writing Seminar II
Prereq: Permission of instructor
G (Spring)
6-0-18 H-LEVEL Grad Credit
Continuation of topics introduced in 21W.825, including research, science journalism, and essays; social and historical context of science and technology; workshops and critiques of student writing. Special emphasis on literary and imaginative science writing that employs traditionally fictional devices in nonfiction, including scene-setting and storytelling; exploration of the boundaries between nonfiction and fiction; relationships between word and image. Extension of science writing principles to non-print domains, such as websites, radio, television, museum exhibits, and multimedia.
*R. Kanigel, T. Levenson, M. Bartusiak, Staff

21W.892 Science Writing Internship
Prereq: Permission of instructor
G (Summer)
0-12-0 [P/D/F] H-LEVEL Grad Credit
Field placements tailored to the individual backgrounds of the students enrolled, involving varying degrees of faculty participation and supervision.
*R. Kanigel, Staff

21W.898 Special Graduate Elective in Science Writing
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit

21W.899 Special Graduate Elective in Science Writing
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
Elective choices and sequences arranged by staff to complement the enrolled students’ program of research and study.
*R. Kanigel, Staff

21W.ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring)
6-0-18 H-LEVEL Grad Credit
Can be repeated for credit
Research and writing of thesis in consultation with faculty, including individual meetings and group seminars, undertaken over the course of one year.
*R. Kanigel, Staff

For individual research in writing and humanistic studies, register for 21W.UR or 21W.URG.

Please note: philosophy subjects are listed under Course 24 Linguistics and Philosophy.

Subjects in Science, Technology, and Society and Comparative Media Studies are listed under those headings.

Information about the following programs may be found under the School of Humanities, Arts, and Social Sciences in Part 2: American Studies, Ancient and Medieval Studies, Latin American Studies, Psychology, Russian Studies, and Women’s and Gender Studies.
To register for individual research or thesis in a specific Humanities section, see the note at the end of each section’s subject listing.

Anthropology (21A)
Foreign Languages and Literatures (21F)
History (21H)
Literature (21L)
Music and Theater Arts (21M)
Writing and Humanistic Studies (21W)

21.ThT Humanities Pre-Thesis Tutorial
Prereq: As specified for particular field
U (Fall, Spring)
1-0-5
Can be repeated for credit

Definition of and early-stage work on thesis project leading to 21.ThU Undergraduate Thesis in Humanities. Taken during the first term of the student’s two-term commitment to the thesis project. Student works closely with an individual faculty tutor. Required for all students in Course 21, and those doing 21-E and 21-S degrees, for whom the thesis is a degree requirement.

Consult D. K. Fitzgerald

21.ThU Undergraduate Thesis in Humanities
Prereq: 21.ThT
U (Fall, Spring)
Units arranged
Can be repeated for credit

Completion of work on the senior major thesis under supervision of a faculty tutor. Includes oral presentation of thesis progress early in the term, assembling and revising the final text, and meeting at the close with a committee of faculty evaluators to discuss the successes and limitations of the project. Required for most students in Course 21 and those doing 21-E and 21-S degrees. (See degree requirements in specific fields.)

Consult D. K. Fitzgerald

21.UR Research in Humanities
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

21.URG Research in Humanities
Prereq: —
U (Fall, Spring)
Units arranged
Can be repeated for credit

Individual participation in an ongoing research project. For students in the Undergraduate Research Opportunities Program.

Consult D. K. Fitzgerald
UNDERGRADUATE SUBJECTS

22.00 Introduction to Modeling and Simulation
Engineering School-Wide Elective Subject.
(Ofﬁered under: 1.021, 2.088, 3.021, 10.333, 18.361, 22.00, HST.558)
Prereq: 18.03
U (Spring)
3-0-9 REST

Basic concepts of computer modeling in science and engineering using discrete particle systems and continuum fields. Techniques and software for statistical sampling, simulation, data analysis, and visualization. Use of statistical, quantum chemical, molecular dynamics, Monte Carlo, mesoscale and continuum methods to study fundamental physical phenomena encountered in the ﬁelds of computational physics, chemistry, mechanics, materials science, biology, and applied mathematics. Applications drawn from a range of disciplines to build a broad-based understanding of complex structures and interactions in problems where simulation is on equal footing with theory and experiment. Term project allows development of individual interest. Student mentoring by a coordinated team of participating faculty from across the Institute.
M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

22.002J Communicating About Technology: Colossal Failures in Engineering (New)
(Same subject as 1.588J, 3.070J, 21W.781J, ESD.032J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H

See description under subject 21W.781J.
T. Eagar, W. Haas, A. Kadak, P. Lagacé

22.01 Introduction to Ionizing Radiation
Prereq: —
U (Fall)
5-0-7 REST

Introduction to basic properties of ionizing radiation and their uses in medicine, industry, science, and environmental studies. Discusses natural and man-made radiation sources, energy deposition and dose calculations, various physical, chemical, and biological processes and effects of radiation with examples of their uses, and principles of radiation protection.
J. C. Yanch

22.011 Seminar in Nuclear Science and Engineering
Prereq: —
U (Fall)
2-0-4
Surveys the range of diverse subjects in nuclear science and engineering covered by the department. Topics include quantum computing, energy and power, radiation effects—stem cells and DNA, BNCT, nuclear space applications, fusion, airport security, accelerators, magnetic repon-sance imaging, non-proliferation, risk assessment, safety, biology, and medicine. A demonstration of the MIT Reactor as a research tool is given as well as a tour of the MIT Tokomak fusion machine and accelerators used in research.
A. Kadak

22.012 Seminar in Fusion and Plasma Physics
Prereq: —
U (Spring)
2-0-4
Lectures and discussion introducing the range of topics relevant to plasma physics and fusion engineering. Introductory discussion of the economic and ecological motivation for the development of fusion power. Contemporary magnetic conﬁnement schemes, theoretical questions, and engineering considerations are presented by expert guest lecturers. Tour of Plasma Science and Fusion Center experimental facilities.
K. Molvig

22.02 Introduction to Applied Nuclear Physics
Prereq: 8.02, 18.02, 22.01
U (Fall)
5-0-7 REST

Basic concepts of nuclear physics with emphasis on nuclear structure and radiation interactions with matter. Elementary quantum theory; nuclear forces; shell structure of the nucleus; alpha, beta, and gamma, radioactive decays; interactions of nuclear radiations (charged particles, gammas and neutrons) with matter; nuclear reactions; fission and fusion.
K. Molvig

22.033 Nuclear Systems Design Project
(Subject meets with 22.33)
Prereq: 22.06
U (Fall)
3-0-9

Group design project involving integration of nuclear physics, particle transport, control, heat transfer, safety, instrumentation, materials, environmental impact, and economic optimization. Provides opportunity to synthesize knowledge acquired in nuclear and non-nuclear subjects and apply this knowledge to practical problems of current interest in nuclear applications design. Past projects have included using a fusion reactor for transmutation of nuclear waste, design and implementation of an experiment to predict and measure pebble ﬂow in a pebble bed reactor, and development of a mission plan for a manned Mars mission including the conceptual design of a nuclear powered space propulsion system and power plant for the Mars surface, a lunar/Martian nuclear power station, and the use of nuclear plants to extract oil from tar sands. Meets with 22.33, but assignments differ.
A. C. Kadak

22.05 Neutron Science and Reactor Physics
Prereq: 22.02, 18.03
U (Fall)
5-0-7

Introduces fundamental properties of the neutron. Covers reactions induced by neutrons,
nuclear fission, slowing down of neutrons in infinite media, diffusion theory, the few-group approximation, point kinetics, and fission-product poisoning. Emphasizes the nuclear physics bases of reactor design and its relationship to reactor engineering problems.

Staff

22.058 Principles of Tomographic Imaging
Prereq: 18.03, 8.02
U (fall)
3-3-6
An introduction to the principles of tomographic imaging and its applications. Includes a series of lectures with a parallel set of recitations that provide demonstrations of basic principles. Both ionizing and non-ionizing radiation are covered, including x-ray, PET, MRI, and ultrasound. Emphasis is on the physics and engineering of image formation.
D. G. Cory

22.06 Engineering of Nuclear Systems
Prereq: 2.005, 22.05
U (Spring)
3-0-9
Introduces engineering in nuclear energy plant design, accelerators and fusion machines. Using the basic principles of nuclear physics, reactor physics, plasma physics and magnetic confinement, heat transfer, safety, risk and reliability, the engineering design of nuclear power plants, accelerators and fusion systems are studied. The MIT reactor, department accelerators, and MIT’s Alcator fusion facility are used.
Staff

22.07 Special Topics in Nuclear Science and Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
22.091 Special Topics in Nuclear Science and Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
22.096 Quantum Mechanics for Nuclear Engineers
(Subject meets with 22.96)
Prereq: —
U (IAP)
1-0-2
Introduction to wave mechanics using optical analogies and examples from nuclear science to gain an intuitive understanding of quantum phenomena. Topics include wave optics and mechanics, the Schrödinger equation and its solution in one dimension, the tunnel effect and radioactive decay, the deuteron and neutron-proton scattering. Math skills introduced as required. Lectures and computer simulation demonstrations. Meets with graduate subject 22.96, but assignments differ. Graduate students are expected to explore the subject in greater depth.
S. H. Chen

22.09 Principles of Nuclear Radiation Measurement and Protection
(Subject meets with 22.90)
Prereq: 22.02
U (Spring)
2-6-4 Institute LAB
Combines lectures, demonstrations, and experiments. Review of radiation protection procedures and regulations; theory and use of alpha, beta, gamma, and neutron detectors; applications in imaging and dosimetry; gamma-ray spectroscopy; design and operation of automated data acquisition experiments using virtual instruments. Meets with 22.90, but homework assignments and examinations differ. Instruction and practice in written communication provided.
J. C. Yanch, R. C. Lanza, L. Hobbs

22.091 Special Topics in Nuclear Science and Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
22.093 Special Topics in Nuclear Science and Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
For undergraduates who wish to conduct a one-term project of theoretical or experimental nature in the field of nuclear engineering, in close cooperation with individual staff members. Topics and hours arranged to fit students’ requirements. Prior approval of Course 22 undergraduate office required for enrollment in 22.093.
D. Cory

22.093 Special Topics in Nuclear Science and Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

22.096 Quantum Mechanics for Nuclear Engineers
(Subject meets with 22.96)
Prereq: —
U (IAP)
1-0-2
Introduction to wave mechanics using optical analogies and examples from nuclear science to gain an intuitive understanding of quantum phenomena. Topics include wave optics and mechanics, the Schrödinger equation and its solution in one dimension, the tunnel effect and radioactive decay, the deuteron and neutron-proton scattering. Math skills introduced as required. Lectures and computer simulation demonstrations. Meets with graduate subject 22.96, but assignments differ. Graduate students are expected to explore the subject in greater depth.
S. H. Chen

22.09 Principles of Nuclear Radiation Measurement and Protection
(Subject meets with 22.90)
Prereq: 22.02
U (Spring)
2-6-4 Institute LAB
Combines lectures, demonstrations, and experiments. Review of radiation protection procedures and regulations; theory and use of alpha, beta, gamma, and neutron detectors; applications in imaging and dosimetry; gamma-ray spectroscopy; design and operation of automated data acquisition experiments using virtual instruments. Meets with 22.90, but homework assignments and examinations differ. Instruction and practice in written communication provided.
J. C. Yanch, R. C. Lanza, L. Hobbs

22.091 Special Topics in Nuclear Science and Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
22.093 Special Topics in Nuclear Science and Engineering
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
For undergraduates who wish to conduct a one-term project of theoretical or experimental nature in the field of nuclear engineering, in close cooperation with individual staff members. Topics and hours arranged to fit students’ requirements. Prior approval of Course 22 undergraduate office required for enrollment in 22.093.
D. Cory

22.096 Quantum Mechanics for Nuclear Engineers
(Subject meets with 22.96)
Prereq: —
U (IAP)
1-0-2
Introduction to wave mechanics using optical analogies and examples from nuclear science to gain an intuitive understanding of quantum phenomena. Topics include wave optics and mechanics, the Schrödinger equation and its solution in one dimension, the tunnel effect and radioactive decay, the deuteron and neutron-proton scattering. Math skills introduced as required. Lectures and computer simulation demonstrations. Meets with graduate subject 22.96, but assignments differ. Graduate students are expected to explore the subject in greater depth.
S. H. Chen

22.EPE UPOP Summer Practice Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPE, 2.EPE, 3.EPE, 10.EPE, 16.EPE, 22.EPE)
Prereq: 2.EPW or permission of instructor
U (Fall)
0-0-3 [P/D/F]
See description under subject 2.EPE.
D. K. P. Yue

22.EPR UPOP Reflective Learning Experience
Engineering School-Wide Elective Subject.
(Offered under: 1.EPR, 2.EPR, 3.EPR, 10.EPR, 16.EPR, 22.EPR)
Prereq: 2.EPE or permission of instructor
U (Fall)
0-0-3 [P/D/F]
See description under subject 2.EPR.
D. K. P. Yue

22.EPW UPOP IAP Workshop
Engineering School-Wide Elective Subject.
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW, 10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]
See description under subject 2.EPW.
D. K. P. Yue

22.ThTu Undergraduate Thesis Tutorial
Prereq: 22.09
U (Fall)
1-0-2 [P/D/F]
A series of lectures on prospectus and thesis writing. Students select a thesis topic and a thesis advisor who reviews and approves the prospectus for thesis work in the spring term.
Staff

22.ThU Undergraduate Thesis
Prereq: 22.ThT
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit
Program of research leading to the writing of an SB thesis, to be arranged by the student and appropriate MIT faculty member. See department undergraduate headquarters.
D. Cory

22.UR Undergraduate Research Opportunities Program
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
22.URG Undergraduate Research Opportunities Program
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
The Undergraduate Research Opportunities Program is an excellent way for undergraduate students to become familiar with the department of Nuclear Science and Engineering. Student
in reactor, accelerator and material structures resulting from single and multiple reactions, and in wave phenomena (optics) and inelastic scattering experiments. Comparison of neutron and fluid transport. Particle simulations. Term paper and presentation required.
S. Yip

Nuclear Reactor Physics

22.211 Nuclear Reactor Physics I
Prereq: 18.075
G (Spring)
3-0-9 H-LEVEL Grad Credit
Reviews the physics basis for modern nuclear reactor design. Topics include the continuous energy transport equation and its adjoint; reduction to diffusion theory and the group diffusion equations; calculation of neutron spectra and determination of few group diffusion constants. The final segment is devoted to heterogeneous reactor analysis.
Staff

22.251 Systems Analysis of the Nuclear Fuel Cycle
Prereq: 22.05
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-2-7 H-LEVEL Grad Credit
Study of the relationship between the technical and policy elements of the nuclear fuel cycle. Topics include uranium supply, enrichment, fuel fabrication, in-core reactivity and fuel management of uranium and other fuel types, used fuel reprocessing and waste disposal. Principles of fuel cycle economics and the applied reactor physics of both contemporary and proposed thermal and fast reactors are presented. Nonproliferation aspects, disposal of excess weapons plutonium, and transmutation of long lived radioisotopes in spent fuel are examined. Several state-of-the-art computer programs relevant to reactor core physics and heat transfer are provided for student use in problem sets and term papers.
M. S. Kazimi, Staff

Nuclear Reactor Engineering

22.312 Engineering of Nuclear Reactors
Prereq: 2.001 and 2.005 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Engineering principles of nuclear reactors, emphasizing power reactors. Power plant thermo-dynamics, reactor heat generation and removal (single-phase as well as two-phase coolant flow and heat transfer), and structural mechanics. Engineering considerations in reactor design.
J. Buongiorno

22.313] Thermal Hydraulics in Power Technology
( Same subject as 2.59, 10.536j)
Prereq: 2.006, 10.302, 22.312, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
J. Buongiorno

22.314] Structural Mechanics in Nuclear Power Technology
( Same subject as 1.56 j, 2.084j)
Prereq: 2.001 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Structural components in nuclear power plant systems, their functional purposes, operating conditions, and mechanical/structural design requirements. Combines mechanics techniques with models of material behavior to determine adequacy of component design. Considerations include mechanical loading, brittle fracture, inelastic behavior, elevated temperatures, neutron irradiation, vibrations and seismic effects.
M. S. Kazimi, O. Buyukozturk
22.33 Nuclear Engineering Design
(Subject meets with 22.033)
Prereq: 22.312
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 22.033.
A. C. Kadak

22.38 Probability and Its Applications
To Reliability, Quality Control, and Risk Assessment
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

22.39 Integration of Reactor Design,
Operations, and Safety
Prereq: 22.211, 22.312
G (Fall)
3-2-7 H-LEVEL Grad Credit
Integration of reactor physics and engineering sciences into nuclear power plant design focusing on designs that are projected to be used in the first half of this century. Topics include materials issues in plant design and operations, aspects of thermal design, fuel depletion and fission-product poisoning, and temperature effects on reactivity. Safety considerations in regulations and operations such as the evolution of the regulatory process, the concept of defense in depth, general design criteria, accident analysis, probabilistic risk assessment, and risk-informed regulations.
N. Todreas, G. Apostolakis, R. Ballinger

22.40] Fundamentals of Advanced Energy
Conversion
(Same subject as 2.62J, 10.392J)
(Subject meets with 2.60)
Prereq: 2.006 or permission of instructor
G (Spring)
4-0-8 H-LEVEL Grad Credit
See description under subject 2.62J.
A. F. Ghoniem, M. Kazimi, Y. Shao-Horn, J. Tester

Radiation Interactions and Applications

22.51 Quantum Theory of Radiation Interactions
Prereq: 22.101, 22.105
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduces elements of applied quantum mechanics and statistical physics. Starting from the experimental foundation of quantum mechanics, develops the basic principles of interaction of electromagnetic radiation with matter. Introduces quantum theory of radiation, time-dependent perturbation theory, transition probabilities and cross sections. Applications are to controlling coherent and decoherent dynamics with examples from quantum information processing.
D. Cory

22.52] Statistical Thermodynamics of Complex Liquids
(Same subject as 8.575J, 10.44J)
Prereq: 8.08, 10.213
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-6 H-LEVEL Grad Credit
See description under subject 10.44J.
D. Blankschtein, S. H. Chen

22.53 Statistical Processes and Atomistic Simulations
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
S. Yip

22.55] Radiation Biophysics
(Same subject as HST.560J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Discusses energy deposition by various types of radiation, including the creation and behavior of secondary radiations. Explores the effects of radiation on biological systems including DNA damage, in vitro cell survival models and in vivo mammalian systems. Covers radiation therapy, radiation syndromes in humans and carcinogenesis. Environmental radiation sources, and aspects of radiation protection are also discussed. Examples from the current literature used to supplement lecture material. Requires a term paper and presentation.
J. A. Coderre

22.56] Noninvasive Imaging in Biology and Medicine
(Same subject as 9.173J, 20.483J, HST.561J)
Prereq: 18.03, 8.03, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Background in the theory and application of noninvasive imaging methods in biology and medicine, with emphasis on neuroimaging. Focuses on the modalities most frequently used in scientific research (x-ray CT, PET/SPECT, MRI, and optical imaging), and includes discussion of molecular imaging approaches used in conjunction with these scanning methods. Lectures are supplemented by in-class discussions of problems in research and demonstrations of imaging systems.
A. Jasanoff

22.56] Magnetic Resonance Analytic,
Biochemical, and Imaging Techniques
(Same subject as HST.584J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-12 H-LEVEL Grad Credit
See description under subject HST.584J.
B. R. Rosen

22.56] Spatial Aspects of Nuclear Magnetic
Resonance Spectroscopy
Prereq: 18.03, 8.05
G (Fall)
3-0-9 H-LEVEL Grad Credit
Discusses the theory and application of nuclear magnetic resonance spectroscopy to questions of the spatial distribution of spins. Covers NMR...
imaging, localized spectroscopy, and local geometries as determined by diffusive processes. The theory is discussed in terms of the density operator and reciprocal space (for both imaging and motional studies). Describes applications to rapid imaging, dynamic imaging, microscopy, and localized spectroscopy. Instrumentation and experimental constraints are also described.

D. G. Cory

**Plasmas and Controlled Fusion**

**22.611J Introduction to Plasma Physics I**

(Same subject as 6.651J, 8.613J)

Prereq: 6.013, 8.07, or 22.105; 18.04 or 18.075

G (Fall)

3-0-9 H-LEVEL Grad Credit


R. Parker, I. Hutchinson, J. Freidberg

**22.612J Introduction to Plasma Physics II**

(Same subject as 6.652J, 8.614J)

Prereq: 6.651J, 8.613J, or 22.611J

G (Spring)

3-0-9 H-LEVEL Grad Credit

See description under subject 8.614J.

Staff

**22.615 MHD Theory of Fusion Systems**

Prereq: 22.611J, 6.651J, or 8.613J

Acad Year 2007–2008: Not offered

Acad Year 2008–2009: G (Spring)

3-0-9 H-LEVEL Grad Credit

Discussion of MHD equilibria in cylindrical, toroidal, and noncircular configurations. MHD stability theory including the Energy Principle, interchange instability, ballooning modes, second region of stability, and external kink modes. Description of current configurations of fusion interest.

J. P. Freidberg

**22.616 Plasma Transport Theory**

Prereq: 22.615

Acad Year 2007–2008: G (Fall)

Acad Year 2008–2009: Not offered

3-0-9 H-LEVEL Grad Credit

The Fokker-Planck operator for Coulomb collisions, including the Landau and Rosenbluth potential forms, is derived, expanded to obtain useful limits, and used to define characteristic times. Classical collisional transport in an arbitrary magnetic field is developed first, and then the high (Pfirsch-Schluter), low (banana), and intermediate (plateau) collisionality regimes of tokamak transport are examined with emphasis on the banana regime where bootstrap current is most pronounced. Gyrokinetics and zonal flow is discussed.

P. Catto

**22.62 Fusion Energy**

Prereq: 22.611J

G (Spring)

3-0-9 H-LEVEL Grad Credit

Basic nuclear physics and plasma physics for controlled fusion. Fusion cross-sections and consequent conditions required for ignition and energy production. Principles of magnetic and inertial confinement. Description of magnetic confinement devices: tokamaks, stellarators and RFPs, their design and operation. Elementary plasma stability considerations and the limits imposed. Plasma heating by neutral beams and RF. Outline design of the ITER “burning plasma” experiment and a magnetic confinement reactor.

D. Whyte

**22.63 Engineering Principles for Fusion Reactors**

Prereq: Permission of instructor

Acad Year 2007–2008: Not offered

Acad Year 2008–2009: G (Spring)

3-0-9 H-LEVEL Grad Credit


J. Minervini

**22.67 Principles of Plasma Diagnostics**

Prereq: 6.651J, 8.613J, or 22.611J

Acad Year 2007–2008: Not offered

Acad Year 2008–2009: G (Fall)

3-0-9 H-LEVEL Grad Credit

Introduction to the physical processes used to measure the properties of plasmas, especially fusion plasmas. Measurements of magnetic and electric fields, particle flux, refractive index, emission and scattering of electromagnetic waves and heavy particles; their use to deduce plasma parameters such as particle density, pressure, temperature, and velocity, and hence the plasma confinement properties. Discussion of practical examples and assessments of the accuracy and reliability of different techniques.

I. H. Hutchinson

**Nuclear Materials**

**22.70 Materials for Nuclear Applications**

Prereq: Permission of instructor

Acad Year 2007–2008: Not offered

Acad Year 2008–2009: G (Spring)

3-0-9 H-LEVEL Grad Credit

Introductory subject for students who are not specializing in nuclear materials. Applications and selection of materials for use in nuclear applications. Radiation damage, radiation effects, and their effects on performance of materials in fission and fusion environments.

L. Hobbs

**22.71J Modern Physical Metallurgy**

(Same subject as 3.40J)

Prereq: 3.14

Acad Year 2007–2008: Not offered

Acad Year 2008–2009: G (Fall)

3-0-9 H-LEVEL Grad Credit

See description under subject 3.40J.

K. J. Van Vliet, C. Schuh

**22.72J Corrosion: The Environmental Degradation of Materials**

(Same subject as 3.54J)

Prereq: 3.012

Acad Year 2007–2008: Not offered

Acad Year 2008–2009: G (Spring)

3-0-9 H-LEVEL Grad Credit

See description under subject 3.54J.

R. G. Ballinger

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*Subjects 22.33 to 22.72J*
22.76 Nuclear Chemical Engineering
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit


Staff

22.77 Nuclear Waste Management
Prereq: 22.76 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit


R. K. Lester, Staff

Systems, Policy, and Economics

22.811J Sustainable Energy
(Same subject as 1.818J, 2.65J, 10.391J, 11.371J, ESD.166J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit

See description under subject 10.391J.
M. W. Golay, J. W. Tester, J. P. Freidberg

22.812J Managing Nuclear Technology
(Same subject as ESD.163J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Examines current economic, management, and policy issues concerning nuclear power and its fuel cycle. Introduces methods for analyzing private and public policy alternatives, including techniques in economic and financial analysis. Application to specific problem areas, including nuclear waste management, weapons proliferation, and the economic competitiveness of nuclear power. Other topics include deregulation and restructuring in the electric power industry.

R. K. Lester

22.813 Applications of Technology in Energy and the Environment
Engineering School-Wide Elective Subject.
(Offered under: 1.149, 2.63, 5.00, 10.579, 22.813, ESD.174)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Introduces advanced undergraduates or graduate students in the Schools of Engineering and Science to the integration of technical, economic, political, and environmental considerations required for the successful implementation of new technology. Case studies are drawn from the energy and environment sectors with some emphasis on analytic techniques that serve as a “tool box” for students. Technologies considered include fossil, nuclear, solar, wind, fuel cell and energy conservation. International aspects, such as weapons proliferation and global climate effects, also discussed. Enrollment limited.

J. Deutch, R. Lester

22.82 Engineering Risk-Benefit Analysis
Engineering School-Wide Elective Subject.
(Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject ESD.72.
G. E. Apostolakis

22.90 Nuclear Science and Engineering Laboratory
(Subject meets with 22.09)
Prereq: 22.101
G (Spring)
2-6-4 H-LEVEL Grad Credit

See description under subject 22.09.
J. C. Yanch, R. C. Lanza, L. Hobbs

22.901–22.904 Special Problems in Nuclear Science and Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

For graduate and advanced undergraduate students who wish to conduct a one-term project of a theoretical or experimental nature in the nuclear engineering field, in close cooperation with individual staff members. Arrangement of topic and hours to fit students’ requirements.

J. A. Codderre

22.905 Special Topics in Nuclear Science and Engineering
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Special topics for graduate and advanced undergraduate students.

J. A. Codderre

22.911 Seminar in Nuclear Science and Engineering
Prereq: —
G (Fall)
2-0-1 [P/D/F]
Can be repeated for credit

22.912 Seminar in Nuclear Science and Engineering
Prereq: —
G (Spring)
2-0-1 [P/D/F]
Can be repeated for credit

Restricted to graduate students engaged in doctoral thesis research.
A. Kadak, A. Jasanoff, I. Hutchinson

22.915 Seminar in Magnetic Resonance
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
2-0-1 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Discusses current topics in magnetic resonance including research issues by graduate students and staff members.
D. G. Cory
22.920 Interactive Introduction to Nuclear Magnetic Resonance
(Same subject as 8.22J)
Prereq: 18.02
G (IAP)
1-2-0 H-LEVEL Grad Credit

Interactive introduction to NMR presenting background in classical theory and instrumentation. Each lecture followed by lab experiments both to demonstrate ideas presented during the lecture and to familiarize students with state-of-the-art NMR instrumentation. Experiments cover topics ranging from spin dynamics to spectroscopy, and include both imaging and quantum information processing.

D. G. Cory, S. D. Sewell

22.921 Nuclear Power Plant Dynamics and Control
Prereq: —
G (IAP)
1-0-2

Introduction to reactor dynamics including subcritical multiplication, critical operation in absence of thermal feedback effects and effects of xenon, fuel and moderator temperature, etc. Derivation of point kinetics and dynamic period equations. Techniques for reactor control including signal validation, supervisory algorithms, model-based trajectory tracking, and rule-based control. Overview of light-water reactor startup. Lectures and demonstrations with use of the MIT Research Reactor. Open to undergraduates with permission of instructor.

J. A. Bernard

22.93 Teaching Experience in Nuclear Science and Engineering
Prereq: Permission of department
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit

For qualified graduate students interested in teaching as a career. Classroom, laboratory, or tutorial teaching under the supervision of a faculty member. Students selected by interview. Credits for this subject may not be used toward master’s or engineer’s degrees. Enrollment limited by the availability of suitable assignments.

I. H. Hutchinson

22.94 Research in Nuclear Science and Engineering
Prereq: Permission of research supervisor
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

For research assistants in Nuclear Science and Engineering who have not completed the NSE doctoral qualifying exam. Hours arranged with and approved by the research supervisor. Units may not be used towards advanced degree requirements.

J. A. Coderre

22.96 Quantum Mechanics for Nuclear Engineers
(Subject meets with 22.096)
Prereq: —
G (IAP)
1-0-2

See description under subject 22.096.

S. H. Chen

22.ThG Graduate Thesis
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research leading to the writing of an SM, NE, PhD, or ScD thesis; to be arranged by the student and an appropriate MIT faculty member. Consult department graduate office.

J. A. Coderre
PHILOSOPHY

24.00 Problems of Philosophy
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H
Introduction to the problems of philosophy, in particular, to problems in ethics, metaphysics, theory of knowledge, and philosophy of logic, language, and science. A systematic rather than historical approach. Readings from classical and contemporary sources, but emphasis is on examination and evaluation of proposed solutions to the problems.
S. Yablo

24.01 Classics of Western Philosophy
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 2, CI-H
Introduction to Western philosophical tradition through the study of selected major thinkers such as Plato, Aristotle, Lucretius, Descartes, Hobbes, Leibniz, Locke, Berkeley, Hume, Kant, Nietzsche and Marx. Emphasis on changes of intellectual outlook over time, and the complex interplay of scientific, religious and political concerns that influence the development of philosophical ideas.
R. Langton

24.02 Moral Problems and the Good Life
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 2, CI-H
Introduction to important philosophical debates about moral issues and what constitutes a good life: What is right, what is wrong, and why? How important are personal happiness, longevity, and success if one is to live a good life? When is it good for you to get what you want? To what extent are we morally obliged to respect the rights and needs of others? What do we owe the poor, the discriminated, our loved ones, animals and fetuses?
S. Haslanger

24.04J Justice
(Same subject as 17.01J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H
Examines alternative theories of justice—utilitarianism, rights theories, social contract theory, and communitarianism—and the implications of those theories for problems of liberty, equality, and community. Readings drawn principally from the work of contemporary political philosophers, including Rawls, Nozick, Dworkin, Walzer, MacIntyre, and Buchanan.
U. Mehta

24.06J Bioethics
(Same subject as STS.006J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H
Considers ethical questions that have arisen from the growth of biomedical research and the health-care industry since World War II. Should doctors be allowed to help patients end their lives? If so, when and how? Should embryos be cloned for research and/or reproduction? Should parents be given control over the genetic make-up of their children? What types of living things are appropriate to use as research subjects? How should we distribute scarce and expensive medical resources? Draws on philosophy, history, and anthropology to show how problems in bioethics can be approached from a variety of perspectives.
C. Hare, D. Jones

24.09 Minds and Machines
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H
Introduction to philosophy of mind. Can computers think? Is the mind an immaterial thing? Alternatively, is the mind the brain? How can creatures like ourselves think thoughts that are about things? Can I know whether your experiences are the same as mine when we both look at raspberries, fire trucks, and stoplights? Can consciousness be given a scientific explanation?
A. Byrne

24.111 Philosophy of Quantum Mechanics
Prereq: —
U (Fall)
3-0-9 HASS
Quantum mechanics is said to describe a world in which physical objects often lack “definite” properties, indeterminism creeps in at the point of “observation,” ordinary logic does not apply, and distant events are perfectly yet inexplicably correlated. Examination of these and other issues central to the philosophical foundations of quantum mechanics, with special attention to the measurement problem, no-hidden-variables proofs, and Bell’s Inequalities. Rigorous approach to the subject matter nevertheless neither presupposes nor requires the development of detailed technical knowledge of the quantum theory.
B. Skow

24.118 Paradox and Infinity
Prereq: —
U (Fall)
3-0-9 HASS
Different kinds of infinity; the paradoxes of set theory; the reduction of arithmetic to logic; formal systems; paradoxes involving the concept of truth; Gödel’s incompleteness theorems; the nonformalizable nature of mathematical truth; and Turing machines.
A. Rayo

24.120 Moral Psychology
Prereq: —
U (Fall)
3-0-9 HASS
Examines philosophical theories of action and motivation in the light of empirical findings from social psychology, sociology and neuroscience. Topics include belief, desire, and moral motivation; sympathy and empathy; intentions and other committing states; strength of will and weakness of will; free will; addiction and compulsion; guilt, shame and regret; evil; self-knowledge and self-deception; virtues and character traits.
R. Holton
24.201 Topics in the History of Philosophy  
Prereq: One HASS-D in philosophy or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
3-0-9 HASS  
Can be repeated for credit with permission of instructor and advisor  
Close examination of a small number of issues central to recent philosophy of science, such as the demarcation problem, causal relations, laws of nature, underdetermination of theory by data, paradoxes of confirmation, scientific realism, the role of mathematics in science, elimination of bias, and the objectivity of scientific discourse.  
R. White

24.209 Philosophy in Film and Other Media  
Prereq: —  
U (Fall)  
3-0-9 HASS  
Works of film examined in relation to thematic issues of philosophical importance that also occur in other arts, particularly literature and opera. Emphasis on film’s ability to represent and express feeling as well as cognition.  
I. Singer

24.211 Theory of Knowledge  
Prereq: One philosophy subject  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
3-0-9 HASS  
Study of problems concerning our concept of knowledge, our knowledge of the past, our knowledge of the thoughts and feelings of ourselves and others, and our knowledge of the existence and properties of physical objects in our immediate environment.  
R. White

24.213 Philosophy of Film  
(Subject meets with CMS.820)  
Prereq: —  
U (Spring)  
3-0-9 HASS  
Philosophical analysis of film art, with an emphasis on the ways in which it creates meaning through techniques that define a formal structure. Particular focus on aesthetic problems about appearance and reality, literary and visual effects, communication and alienation through film technology.  
I. Singer

24.215 Topics in the Philosophy of Science  
Prereq: One philosophy subject  
U (Fall)  
3-0-9 HASS  
Can be repeated for credit  
Close examination of a small number of issues central to recent philosophy of science, such as

24.221 Metaphysics  
Prereq: One philosophy subject  
U (Spring)  
3-0-9 HASS  
Study of basic metaphysical issues concerning existence, the mind-body problem, personal identity, and causation plus its implications for freedom. Classical as well as contemporary readings.  
S. Haslanger

24.222 Decisions, Games and Rational Choice  
Prereq: —  
U (Spring)  
3-0-9 HASS  
Foundations and philosophical applications of Bayesian decision theory, game theory and theory of collective choice. Why should degrees of belief be probabilities? Is it always rational to maximize expected utility? If so, why and what is its utility? What is a solution to a game? What does a game-theoretic solution concept such as Nash equilibrium say about how rational players will, or should, act in a game? How are the values and the actions of groups, institutions and societies related to the values and actions of the individuals that constitute them?  
R. Stalnaker

24.223 Ethics  
Prereq: One philosophy subject  
U (Spring)  
3-0-9 HASS  
Systematic study of central theories in ethics, including egoism, act and rule utilitarianism, intuitionism, emotivism, rights theories, and contractualism. Discussion and readings also focus on problems associated with moral conflicts, justice, the relationship between rightness and goodness, objective vs. subjective moral judgments, moral truth, and relativism.  
B. Skow

24.235J Philosophy of Law  
(Subject meets with 17.006, 17.007J, SP.601J)  
Prereq: —  
U (Spring)  
3-0-9 HASS  
Examination of fundamental issues in philosophy of law, such as the nature and limits of law and a legal system, and the relation of law to morality, with particular emphasis on the philosophical issues and problems associated with privacy, liberty, justice, punishment, and responsibility. Historical and contemporary readings, including court cases.  
Staff

24.236J Feminist Theory  
Prereq: —  
U (Spring)  
3-0-9 HASS  
See description under subject SP.601.  
E. Wood

24.241 Logic I  
Prereq: —  
U (Fall)  
3-0-9 HASS  
Introduction to the aims and techniques of formal logic. The logic of truth functions and quantifiers. The concepts of validity and truth and their relation to formal deduction. Applications of logic and the place of logic in philosophy.  
V. McGee

24.242 Logic II  
Prereq: 24.241 or permission of instructor  
U (Spring)  
3-0-9 HASS  
The central results of modern logic: the completeness of predicate logic, recursive functions, the incompleteness of arithmetic, the unprovability of consistency, the indefinability of truth, Skolem-Löwenheim theorems, and nonstandard models.  
V. McGee

24.243 Classical Set Theory  
Prereq: 24.241 or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9 HASS  
Introduction to the basic concepts and results of standard, i.e., Zermelo-Fraenkel, set theory, the axioms of ZF, ordinal and cardinal arithmetic, the structure of the set-theoretic universe, the
axiom of choice, the (generalized) continuum hypothesis, inaccessibles, and beyond.
V. McGee

24.244 Modal Logic
Prereq: 24.241
U (Fall)
3-0-9 HASS

Sentential and quantified modal logic, with emphasis on the model theory ("possible worlds semantics"). Soundness, completeness, and characterization results for alternative systems. Tense and dynamic logics, epistemic logics, as well as logics of necessity and possibility. Applications in philosophy, theoretical computer science, and linguistics.
R. Stalnaker

24.251 Introduction to Philosophy of Language
Prereq: One philosophy subject
U (Fall)
3-0-9 HASS

Examination of views on the nature of meaning, reference, truth, and their relationships. Other topics may include relationships between language and logic, language and knowledge, language and reality, language and acts performed through its use. No knowledge of logic or linguistics presupposed.
R. Holton

24.253 Philosophy of Mathematics
Prereq: One philosophy subject or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Philosophical issues about or related to mathematics, including the existence and nature of basic mathematical objects such as numbers and sets, how we can come to have knowledge of such objects, the status of mathematical truth, the relation of mathematics to logic, and whether classical logic can be called into question.
V. McGee

24.260 Topics in Philosophy
Prereq: Two subjects in philosophy
U (Spring)
3-0-9 HASS

Close examination of a single book, or group of related essays, with major significance in recent philosophy. Subject matter varies from year to year. Intended primarily for majors and minors in philosophy. Opportunities are provided for oral presentation. Students revise at least one paper in response to instructor’s comments.
A. Rayo

24.261 Philosophy of Love in the Western World
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Studies the nature of love and sex, approached as topics both in philosophy and in literature. Readings from recent philosophy as well as classic myths of love that occur in works of literature and lend themselves to philosophical analysis.
I. Singer

24.262 Feeling and Imagination in Art, Science, and Technology
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Seminar on the creativity in art, science, and technology. Discussion of how these pursuits are jointly dependent on affective as well as cognitive elements in human nature. Feeling and imagination studied in relation to principles of idealization, consumption, and the aesthetic values that give meaning to science and technology as well as literature and the other arts. Readings in philosophy, psychology, and literature.
H. Liu, I. Singer

24.263 The Nature of Creativity
(Subject meets with CMS.810)
Prereq: —
U (Spring)
3-0-9 HASS

Introduction to problems about creativity as it pervades human experience and behavior. Questions about imagination and innovation studied in relation to the history of philosophy as well as more recent work in philosophy, affective psychology, cognitive studies, and art theory. Readings and guidance with student’s focus of interest.
I. Singer

24.264 Film as Visual and Literary Philosophy
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

Problems in the philosophy of film as well as literature studied in relation to their making of myths. Readings and film that draw upon classic myths of the Western world. Emphasis on meaning and technique as the basis of creative value in both media.
I. Singer

24.265 Aesthetics and Philosophy of the Arts (New)
Prereq: One subject in philosophy or permission of instructor
U (Fall)
3-0-9 HASS

Introduction to the aesthetic element of experience and its relation to literature, music, film, and the media arts. Topics include the unity of affect and cognition; the nature of imagination and artistic creativity; and the aesthetic foundations of ethics, science and religion.
I. Singer

24.280 Foundations of Probability
Prereq: One philosophy subject or one subject on probability
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS

Topics include probability puzzles, common fallacies in probabilistic reasoning, defenses and criticisms of Kolmogorov’s axiomatization, interpretations of probability (including the frequency, logical, propensity, and various subjectivist interpretations), the relation of objective chance to rational subjective credence, conditional probability, rules for updating probability, and proposals for supplementing the probability calculus with further principles.
V. McGee

24.292 Special Topics in Philosophy
Prereq: Any two subjects in philosophy
Units arranged

24.293 Special Topics in Philosophy
Prereq: Any two subjects in philosophy
Units arranged

Open to qualified students who wish to pursue special studies or projects. Students electing this subject must consult the department head.
Staff

24.400 Proseminar in Philosophy I
Prereq: Permission of instructor
G (Fall)
6-0-18 H-LEVEL Grad Credit

24.401 Proseminar in Philosophy II
Prereq: Permission of instructor
G (Spring)
6-0-18 H-LEVEL Grad Credit

Advanced study of the basic problems of philosophy. Intended for first-year graduate students in philosophy.
Fall: A. Byrne, S. Haslanger
Spring: R. Stalnaker, R. White
24.410 Topics in the History of Philosophy
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor and advisor

Intensive study of a philosopher or philosophical movement. Content varies from year to year.
R. Langton

24.500 Topics in Philosophy of Mind
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Selected topics in philosophy of mind. Content varies from year to year. Topics may include consciousness, mental representation, perception, and mental causation.
A. Byrne

24.501 Problems in Metaphysics
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor and advisor

Systematic examination of selected problems in metaphysics. Content varies from year to year.
R. Stalnaker

24.502 Topics in Metaphysics and Ethics
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor and advisor

Systematic examination of selected problems concerning the relation between metaphysics and ethics, for example questions about personal identity and its relation to issues about fairness and distribution, or questions about the relation between causation and responsibility. Content may vary from year to year.
R. Holton

24.601 Topics in Moral Philosophy
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor and advisor

Systematic examination of selected problems in moral philosophy. Content varies from year to year.
C. Hare

24.611j Political Philosophy
(Same subject as 17.000j)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

See description under subject 17.000j.
U. Mehta

24.711 Topics in Philosophical Logic
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor and advisor

Problems of ontology, epistemology, and philosophy of language that bear directly on questions about the nature of logic and the conceptual analysis of logical theory, such as logical truth, logical consequence, and proof. Content varies from year to year.
Fall: A. Raya
Spring: V. McGee

24.729 Topics in Philosophy of Language
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor

Major issues in the philosophy of language. Topics change each year.
S. Yablo

24.801 Philosophy of Mathematics
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Examination of major philosophies of mathematics—logicism, formalism, intuitionism—on the nature of mathematical proof, existence of mathematical entities, and related issues. It is strongly recommended that students have taken 24.241 or equivalent.
S. Yablo

24.805 Topics in Theory of Knowledge
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor

Major issues in theory of knowledge. Topics change each year.
R. White

24.810 Topics in Philosophy of Science
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor and advisor

Topics in the foundations of science: the nature of concepts and theories, the distinction between empirical and theoretical knowledge claims, realist and instrumentalist interpretation of such claims, and the analysis of scientific explanation. The central topic varies from year to year.
B. Skow

24.891 Special Graduate Topics in Philosophy
Prereq: Permission of advisor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

24.892 Special Graduate Topics in Philosophy
Prereq: Permission of advisor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Open to qualified graduate students in philosophy who wish to pursue special studies or projects.
Consult Department Headquarters

24.899 Topics in Linguistics and Philosophy
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit

Selected topics at the intersection of linguistics and philosophy. Intended for graduate students in either linguistics or philosophy. Topics vary from year to year.
K. von Fintel

24.UR Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Research opportunities in linguistics and philosophy. For further information, consult the departmental coordinators.
Linguistics: I. Heim
Philosophy: S. Yablo
24. URG Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Research opportunities in linguistics and philosophy. For further information consult the departmental coordinators.

Linguistics: I. Heim
Philosophy: S. Yablo

LINGUISTICS

24.900 Introduction to Linguistics
Prereq: —
U (Fall, Spring)
4-0-8 HASS-D, Category 2, CI-H

Studies what is language and what does knowledge of a language consist of. It asks how do children learn languages and is language unique to humans; why are there many languages; how do languages change; is any language or dialect superior to another; and how are speech and writing related. Context for these and similar questions provided by basic examination of internal organization of sentences, words, and sound systems. Assumes no prior training in linguistics.

Fall: D. Pesetsky
Spring: S. Flynn

24.901 Language and Its Structure I: Phonology
(Same subject as 24.931)
Prereq: 24.900
U (Fall)
3-0-9 HASS

Introduction to fundamental concepts in phonological theory and their relation to issues in philosophy and cognitive psychology. Articulatory and acoustic phonetics, distinctive features and the structure of feature systems, underlying representations and underspecification, phonological rules and derivations, syllable structure, acccentual systems, and the morphology-phonology interface. Examples and exercises from a variety of languages.

A. Albright

24.902 Language and Its Structure II: Syntax
(Same subject as 24.932)
Prereq: 24.900
U (Fall)
3-0-9 HASS

Introduction to fundamental concepts in syntactic theory and its relation to issues in philoso-

24.903 Language and Its Structure III: Semantics and Pragmatics
(Same subject as 24.933)
Prereq: 24.900
U (Spring)
3-0-9 HASS


K. von Fintel

24.904 Language Acquisition
(Same subject as 9.57J)
Prereq: 24.900 or permission of instructor
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: U (Fall)
3-0-9 HASS

See description under subject 9.57J.

K. Wexler

24.905 Psycholinguistics
(Same subject as 9.59J)
Prereq: 9.00, 24.900 or permission of instructor
U (Spring)
3-0-9 HASS

See description under subject 9.59J.

E. Gibson

24.906 The Linguistic Study of Bilingualism
(Same subject as 21F.024J)
Prereq: —
U (Fall)
3-0-9 HASS, CI-H

Development of bilingualism in human history (from Lucy to present day). Focuses on linguistic aspects of bilingualism; models of bilingualism and language acquisition; competence versus performance; effects of bilingualism on other domains of human cognition; brain imaging studies; early versus late bilingualism; opportunities to observe and conduct original research; and implications for educational policies among others. Taught in English. Enrollment limited.

S. Flynn

24.907 Abnormal Language
(Same subject as 9.56J)
Prereq: 24.900 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9

See description under subject 9.56J.

K. Wexler

24.908 Creole Languages and Caribbean Identities
Prereq: —
U (Spring)
3-0-9 HASS, CI-H

Caribbean Creole languages result from language contact via colonization and the slave trade. Explores creolization from cognitive, historical and comparative perspectives and evaluates popular theories about “Creole genesis” and the role of language acquisition. Also explores non-linguistic creolization—in literature, religion and music in the Caribbean—and addresses issues of Caribbean identities by examining Creole speakers’ and others’ beliefs toward Creole cultures. Draws comparisons with aspects of African-American culture.

M. DeGraff

24.910 Topics in Linguistic Theory
Prereq: Four subjects in linguistics
U (Spring)
3-0-9 HASS
Can be repeated for credit

Review in depth of a major interface topic in current linguistic theory. Students learn through their own writing-and-presentation intensive practice and from the instructor’s regular feedback.

Staff

24.919 Special Undergraduate Topics in Linguistics
Prereq: —
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

Open to qualified students who wish to pursue special studies or projects.

Consult Department Headquarters
24.921 Special Graduate Topics in Linguistics  
Prereq: Permission of advisor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit

24.922 Special Graduate Topics in Linguistics  
Prereq: Permission of advisor  
G (Fall, Spring, Summer)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit

Open to qualified graduate students in linguistics who wish to pursue special studies or projects.  
Consult Department Headquarters

24.931 Language and Its Structure I: Phonology  
(Subject meets with 24.901)  
Prereq: 24.900 or permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Meets with 24.901, but assignments differ. See description under 24.901.  
A. Albright

24.932 Language and Its Structure II: Syntax  
(Subject meets with 24.902)  
Prereq: 24.900 or permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Meets with 24.902, but assignments differ. See description under 24.902.  
N. Richards

24.933 Language and Its Structure III: Semantics and Pragmatics  
(Subject meets with 24.903)  
Prereq: 24.900 or permission of instructor  
G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Meets with 24.903, but assignments differ. See description under 24.903.  
K. von Fintel

24.941J The Lexicon and Its Features  
(Same subject as 6.543J, 9.587J, HST.727J)  
Prereq: 24.901 or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Overview of features that distinguish sound categories in languages of the world. Theories that relate these categories to their acoustic and articulatory correlates, both universally and in particular languages. Models of word recognition by listeners. A variety of perspectives on these issues, drawn from electrical engineering and computer science, linguistics and cognitive science.  
D. Gow, D. Steriade, K. N. Stevens, S. Shattuck-Hufnagel

24.942 Topics in the Grammar of a Less Familiar Language  
Prereq: 24.951  
G (Spring)  
3-0-6 H-LEVEL Grad Credit  
Can be repeated for credit  
Detailed examination of the grammar of a language whose structure is significantly different from English, with special emphasis on problems of interest in the study of linguistic universals. A native speaker of the language assists when possible.  
M. Kenstowicz, N. Richards

24.944 Neurolinguistics  
Prereq: Permission of instructor (some background in linguistics)  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Discusses what is known about the representation and processing of language in the brain and what current techniques are being used to expand our knowledge. Deficit/lesion studies (e.g., aphasia research), electromagnetic research (e.g., ERP, MEG), and metabolic techniques (e.g., PET, fMRI) reviewed. Emphasis on current work exploiting ERP, MEG, and fMRI methodology. Hands-on experience with MEG technology provided.  
Staff

24.945J Language Processing  
(Same subject as 9.591J)  
Prereq: Permission of instructor  
G (Fall)  
3-0-6 H-LEVEL Grad Credit  
See description under subject 9.591J.  
K. Wexler

24.946 Linguistic Theory and Japanese Language  
(Subject meets with 21F.514)  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
3-0-6  
S. Miyagawa

24.947 Language Disorders in Children (New)  
Prereq: —  
G (Fall)  
3-0-9  
Reading and discussion of current linguistic theory, first language acquisition and language disorders in young children. Focus on development of a principled understanding of language disorders at the phonological, morphological and syntactic levels. Examines ways in which these disorders confront theories of language and acquisition.  
S. Flynn

24.948 Linguistic Theory and Second Language Acquisition  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
3-0-6  
Reading and discussion of current linguistic theory, first language acquisition research, and data concerning adult second language acquisition. Focus on development of a theory of second language acquisition within a theory of universal grammar. Emphasis on syntactic, lexical, and phonological development. Examination of ways in which this body of data confronts theories of language.  
S. Flynn

24.949J Language Acquisition I  
(Same subject as 9.601J)  
Prereq: Permission of instructor  
G (Spring)  
3-0-6 H-LEVEL Grad Credit  
See description under subject 9.601J.  
K. Wexler

24.951 Introduction to Syntax  
Prereq: Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Introduction to theories of syntax underlying work currently being done within the lexical-functional and government-binding frameworks. Organized into three interrelated parts, each focused upon a particular area of concern: phrase structure; the lexicon; and principles and parameters. Grammatical rules and processes constitute a focus of attention throughout the course that serve to reveal both modular structure of grammar and interaction of grammatical components.  
M. DeGraff, S. Iatridou
24.952 Advanced Syntax
Prereq: 24.951
G (Spring)
3-0-9 H-LEVEL Grad Credit
Problems in constructing an explanatory theory of grammatical representation. Topics drawn from current work on anaphora, casemarking, control, argument structure, WH- and related constructions. Study of language-particular parameters in the formulation of linguistic universals.
D. Pesetsky, N. Richards

24.953 Lexical Argument Structure and Syntax
Prereq: 24.951
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Detailed investigation of the major issues and problems in the study of lexical argument structure and how it determines syntactic structure. Empirical scope is along three dimensions: typology, lexical class, and theoretical framework. The range of linguistic types include English, Japanese, Navajo, and Warlpiri. Lexical classes include those of Levin’s English verb classes and others producing emerging work on diverse languages. The theoretical emphasis is on structural relations among elements of argument structure.
S. Miyagawa

24.954 Pragmatics in Linguistic Theory
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Formal theories of context-dependency, presupposition, implicature, context-change, focus and topic. Special emphasis on the division of labor between semantics and pragmatics. Applications to the analysis of quantification, definiteness, presupposition projection, conditionals and modality, anaphora, questions and answers.
D. Fox

24.955 More Advanced Syntax
Prereq: 24.951, 24.952
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
An advanced-level survey of topics in syntax.
S. Iatridou

24.956 Topics in Syntax
Prereq: 24.951
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
The nature of linguistic universals that make it possible for languages to differ and place limits on these differences. Study of selected problem areas show how data from particular languages contribute to the development of a strong theory of universal grammar and how such a theory dictates solutions to traditional problems in the syntax of particular languages.
Fall: Staff
Spring: K. von Fintel, S. Iatridou

24.957 Introduction to Linguistic Theory at an Advanced Level
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Discussion of conceptual and methodological issues: goals of linguistic theory and its place in the study of thought and behavior; descriptive and explanatory theories; the nature, use, and acquisition of knowledge of language compared with other cognitive systems; and relations of form, meaning, and language use. Subject examines theories of transformational generative grammar as it has evolved and is presently pursued: theory of base, transformations, semantic interpretation of formal structures, logical form, and conditions on the form and functioning of rules.
Staff

24.959 Workshop in Syntax and Semantics
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
An intensive group tutorial/seminar for discussion of research being conducted by participants. No listeners.
D. Fox

24.960 Syntactic Models
Prereq: 24.951, 24.952
G (Fall)
3-0-9 H-LEVEL Grad Credit
Comparison of different proposed architectures for the syntax module of grammar. Subject traces several themes across a wide variety of approaches, with emphasis on testable differences among models. Models discussed include ancient and medieval proposals, structuralism, early generative grammar, generative semantics, government-binding theory/minimalism, LFG, HPSG, TAG, functionalist perspectives and others.
D. Pesetsky

24.961 Introduction to Phonology
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
Introduction to the current research questions in phonological theory. Topics include metrical and prosodic structure, features and their phonetic basis in speech, acquisition and parsing, phonological domains, morphology, and language change and reconstruction. Activities include problem solving, squibs, and data collection.
M. Kenstowicz, D. Steriade

24.962 Advanced Phonology
Prereq: 24.961
G (Spring)
3-0-9 H-LEVEL Grad Credit
Continuation of 24.961.
A. Albright, D. Steriade

24.963 Linguistic Phonetics
Prereq: —
G (Spring)
3-0-9
The study of speech sounds: how we produce and perceive them and their acoustic properties. The influence of the production and perception systems on phonological patterns and sound change. Acoustic analysis and experimental techniques.
E. Flemming

24.964 Topics in Phonology
Prereq: 24.961
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
In-depth study of a topic in current phonological theory.
M. Kenstowicz, D. Steriade

24.965 Morphology
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
constituent structure, and boundaries. Detailed analysis of languages with complex morphology. 
A. Albright, D. Pesetsky

**24.966j Laboratory on the Physiology, Acoustics, and Perception of Speech**
(Same subject as 6.542I, HST.712I)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
2-2-8 H-LEVEL Grad Credit
See description under subject 6.542I.
K. N. Stevens, J. S. Perkell, S. Shattuck-Hufnagel

**24.967 Topics in Experimental Phonology**
Prereq: 24.961, 24.963, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
Experimental techniques to test predictions drawn from current phonological theory. Includes a survey of experimental methodologies currently in use, an introduction to experimental design and analysis, and critical consideration of how experimental results are used to inform theory.
A. Albright

**24.968j Speech Communication**
(Same subject as 6.541J, HST.710J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject 6.541J.
K. N. Stevens, S. Shattuck-Hufnagel

**24.969 Workshop in Phonology and Morphology**
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
An intensive group tutorial/seminar for discussion of research being conducted by participants. No auditors.
A. Albright, E. Flemming

**24.970 Introduction to Semantics**
Prereq: Permission of instructor
G (Fall)
3-0-9
Basic issues of form and meaning in formalized and natural languages. Conceptual, logical, and linguistic questions about truth. Reference, modal, and intensional notions. The role of grammar in language use and context-dependency. Ambiguities of structure and meaning, and dimensions of semantic variation in syntax and the lexicon.
K. von Fintel

**24.973 Advanced Semantics**
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Current work on semantics and questions of logic and meaning for syntactic systems in generative grammar.
D. Fox

**24.979 Topics in Semantics**
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Seminar on current research in semantics and generative grammar. Topics may vary from year to year.
G. Chierchia, I. Heim

**24.981 Topics in Computational Phonology**
Prereq: 24.961 or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Exploration of issues in the computational modeling of phonology: finding generalizations in data, formalisms for representing phonological knowledge, modeling grammar acquisition, and testing phonological theories by means of implemented models. Experience using and developing models, including preparing training data, running simulations, and interpreting their results. No background in programming or machine learning is assumed.
A. Albright

**24.992 Survey of General Linguistics**
Prereq: Permission of instructor
G (Fall)
3-0-9
Can be repeated for credit
Reading and discussion of certain important papers in syntax, semantics, and phonology designed to familiarize the student with central ideas in current linguistic research. Organization of discussion is primarily in the hands of seminar participants.
M. DeGraff, K. von Fintel, S. Iatridou, M. Kenstowicz, D. Steriade

**24.993 Tutorial in Linguistics and Related Fields**
Prereq: —
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Individual or small-group tutorial in which students, under the guidance of a faculty member, explore the interrelations with linguistics of some specified area.
Consult Department Headquarters

**24.ThG Graduate Thesis**
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research and writing of thesis, to be arranged by the student with supervising committee.
Staff

**24.UR Undergraduate Research**
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Research opportunities in linguistics and philosophy. For further information, consult the departmental coordinators.
Linguistics: I. Heim
Philosophy: S. Yablo

**24.URG Undergraduate Research**
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Research opportunities in linguistics and philosophy. For further information consult the departmental coordinators.
Linguistics: I. Heim
Philosophy: S. Yablo
**UNDERGRADUATE SUBJECTS**

**CMS.400 Media Systems and Texts**  
Prereq: One subject in Comparative Media Studies or permission of instructor  
U (Spring)  
3-3-6 HASS  
Explores theoretical, historical and critical approaches to the comparative study of media. Examines media from three perspectives: the historical evolution of particular media forms (media in transition); the migration of particular narratives across different media forms (transmedia texts); and the ways in which media texts and systems cross cultural and national boundaries (global crossings). Required for CMS majors and minors.  
H. Jenkins

**CMS.600 Topics in Comparative Media Studies**  
Prereq: —  
U (Fall, Spring)  
Units arranged  
Can be repeated for credit  
Open to qualified students who wish to pursue special projects with members of the CMS faculty. Topic for fall 2007: Videogame Theory and Analysis. Topic for spring 2008: New Media Literacies.  
A. Robison

**CMS.601 Topics in Comparative Media Studies**  
Prereq: —  
U (Fall, Spring)  
Units arranged (usually limited to 12)  
Can be repeated for credit  
Open to qualified students who wish to pursue special projects with members of the CMS faculty. Topic for fall 2007 and spring 2008: Character Design and World Making.  
F. Espinosa

**CMS.602 Topics in Comparative Media**  
Prereq: —  
U (Fall, Spring)  
6-6-0  
Can be repeated for credit  
Discussion of current interest special topics not otherwise included in the curriculum. Topic for fall 2007: Television Ecosystem.  
Fall: S. Schulman, A. Chisholm  
Spring: J. Green

**CMS.603 Topics in Comparative Media Studies**  
Prereq: —  
U (Fall, Spring)  
Units arranged  
Can be repeated for credit  
Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.  
Staff

**CMS.610 Media Industries and Systems**  
(Subject meets with CMS.922)  
Prereq: Two CMS subjects or permission of instructor  
U (Fall, Spring)  
3-0-9 HASS  
Can be repeated for credit  
Introduces the creative industries as a paradigm to understand developments in the media and content industries. Explores the significance of creativity and creative entrepreneurship, positioning the creative industries as key sectors of the knowledge economy. Considers the importance for the media and content industries of technological convergence, intellectual property laws, globalization and the rise of the creative class.  
Fall: J. Green  
Spring: C. Weaver

**CMS.602 Topics in Comparative Media Studies Pre-Thesis Tutorial**  
Prereq: Permission of advisor  
U (Fall, Spring)  
1-0-5  
Student works with an advisor to define his/her thesis. By the end of the term student must have a substantial outline and bibliography for thesis and must have selected a three-person thesis committee. Advisor must approve outline and bibliography.  
Staff

**CMS.THU Undergraduate Thesis in Comparative Media Studies**  
Prereq: CMS.TH(T  
U (Fall, Spring)  
Units arranged  
Can be repeated for credit  
A substantial research project or comparable exercise. A written thesis ranges in length from 35 to 50 pages. Digital projects are assessed on the quality of research and argumentation, as well as presentation, and must include a substantial written component. Student gives an oral presentation of his/her thesis at the end of the term. Thesis is not required for CMS majors.  
Staff

**CMS.UR Research in Comparative Media Studies**  
Prereq: —  
U (Fall, IAP, Spring, Summer)  
Units arranged [P/D/F]  
Can be repeated for credit

**CMS.URG Research in Comparative Media Studies**  
Prereq: —  
U (Fall, IAP, Spring, Summer)  
Units arranged  
Can be repeated for credit  
Individual participation in an ongoing research project. For students in the Undergraduate Research Opportunities Program.  
Staff

**GRADUATE SUBJECTS**

**Proseminars**

**CMS.790 Media Theories and Methods I**  
Prereq: Permission of instructor  
G (Fall)  
3-3-6 H-LEVEL Grad Credit  
An advanced introduction to core theoretical and methodological issues in comparative media studies. Topics covered typically include the nature of theory, the gathering and evaluation of evidence, the relationship of media to reality,
formal approaches to media analysis, the ethnographic documentation of media audiences, cultural hierarchy and taste, modes of production, models of readership and spectatorship.

H. Jenkins

CMS.791 Media Theories and Methods II
Prereq: CMS.790
G (Spring)
3-3-6 H-LEVEL Grad Credit

An advanced introduction to core theoretical and methodological issues in comparative media studies. Topics covered typically include globalization, propaganda and persuasion, social and political effects of media change, political economy and the institutional analysis of media ownership, online communities, privacy and intellectual property, and the role of news and information within democratic cultures.

H. Jenkins

CMS.796 Major Media Texts
Prereq: Permission of instructor
G (Fall)
3-3-6 H-LEVEL Grad Credit

Intensive close study and analysis of historically significant media "texts" that have been considered landmarks or have sustained extensive critical and scholarly discussion. Such texts may include oral epic, story cycles, plays, novels, films, opera, television drama and digital works. Emphasizes close reading from a variety of contextual and aesthetic perspectives. Syllabus varies each year, and may be organized around works that have launched new modes and genres, works that reflect upon their own media practices, or on stories that migrate from one medium to another. At least one of the assigned texts is collaboratively taught, and visiting lectures and discussions are a regular feature of the subject.

D. Thorburn

CMS.801 Media in Transition
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Centers on historical eras in which the form and function of media technologies were radically transformed. Includes consideration of the "Gutenberg Revolution," the rise of modern mass media, and the "digital revolution," among other case studies of media transformation and cultural change. Readings in cultural and social history and historiographic method.

J. Ravel

CMS.810 The Nature of Creativity (New)
(Subject meets with 24.263)
Prereq: —
G (Spring)
3-0-9

Introduction to problems about creativity as it pervades human experience and behavior. Questions about imagination and innovation studied in relation to the history of philosophy as well as more recent work in philosophy, affective psychology, cognitive studies, and art theory. Readings and guidance with student’s focus of interest.

I. Singer

CMS.820 Philosophy of Film (New)
(Subject meets with 24.213)
Prereq: —
G (Spring)
3-0-9

See description under 24.213.

I. Singer

Electives

CMS.830 Studies in Film
(Subject meets with 21L.706)
Prereq: Permission of instructor
G (Spring)
3-3-6
Can be repeated for credit

Meets with 21L.706, but assignments differ. See description under 21L.706.

P. Donaldson

CMS.835 Photography and Truth
(Subject meets with 21A.348)
Prereq: Permission of instructor
G (Spring)
3-0-9

Meets with 21A.348, but assignments differ. See description under subject 21A.348.

J. Howe

CMS.840 Literature and Film
(Subject meets with 21L.435)
Prereq: Permission of instructor
G (Spring)
3-3-6
Can be repeated for credit

Meets with 21L.435, but assignments differ. See description under subject 21L.435.

A. Kibel

CMS.845 Interactive and Non-Linear Narrative: Theory and Practice
(Subject meets with 21L.489J, 21W.765J)
Prereq: Permission of instructor
G (Fall)
3-0-9

Meets with 21L.489J/21W.765J, but assignments differ. See description under subject 21W.765J.

E. Barrett

CMS.865 Videogame Theory and Analysis (New)
(Subject meets with CMS.965)
Prereq: —
U (Spring)
3-0-9

Introduction to the interdisciplinary study of commercial videogames as texts, examining their cultural, educational, and social functions in contemporary settings. Readings in educational theory and analysis of the conception and design of a videogame selected in consultation with the instructor.

P. Tan

CMS.871 Media in Cultural Context
(Subject meets with SP.493, 21L.715)
Prereq: Permission of instructor
G (Fall)
3-3-6
Can be repeated for credit

Meets with 21L.715, but assignments differ. See description under 21L.715.

S. Brouillette

CMS.874 Visualizing Cultures
(Subject meets with 21F.027), 21F.590, 21H.917J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9

See description under subject 21F.027.

S. Miyagawa, J. Dower

CMS.876 History of Media and Technology
Prereq: Permission of instructor
G (Spring)
3-3-6
Can be repeated for credit

Mutually influential histories of communications media and technological development, focusing on the shift from analog to digital cultures that began mid-century and continues to the present. Theoretical and philosophical works, histories canonical and minority, literature and art, as well as production issues toward the advance-
ment of student projects and research papers. Each topic in the series reflects a particular theme in the history of media and technology.

B. Coleman

CMS.880 From Print to Digital: Technologies of the Word, 1450–Present
(Subject meets with 21H.418)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
Meets with 21H.418, but assignments differ.
J. Ravel

CMS.882] Film, Fiction, and History in India, 1905-2005
(Same subject as 21H.577J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9
See description under subject 21H.577J.
H. Roy

CMS.888 Advertising and Popular Culture: East Asian Perspectives
(Subject meets with 21F.036, 21F.190)
Prereq: Permission of instructor
G (Spring)
3-0-9
Meets with 21F.036 but assignments differ. See description under subject 21F.036.
J. Wang

Case Studies

CMS.910 Literature and Technology
(Subject meets with 21L.708)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9
Can be repeated for credit
Meets with 21L.708 but assignments differ. See description under 21L.708.
K. Fendt

CMS.915 Understanding Television
(Subject meets with 21L.432)
Prereq: Permission of instructor
G (Spring)
3-3-6
Can be repeated for credit
Meets with 21L.432 but assignments differ. See description under 21L.432.
D. Thorburn

CMS.917 Documenting Culture
(Subject meets with 21A.337)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9
Meets with 21A.337, but assignments differ. See description under 21A.337.
C. Walley

CMS.920 Popular Narrative
(Subject meets with SP.492, 21L.430)
Prereq: Permission of instructor
G (Spring)
3-3-6
Can be repeated for credit
Meets with 21L.430, but assignments differ. Can be taken for graduate credit when topic is approved for Comparative Media Studies. See description under 21L.430.
A. Braithwaite

CMS.922 Media Industries and Systems
(Subject meets with CMS.610)
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9
Examines the interplay of art, technology, and commerce shaping the production, marketing, distribution, and consumption of contemporary media content. Combines perspectives on media industries and systems with an awareness of the creative process, the audience, and trends shaping content. Guest speakers from the media industry. Projects encourage students to think through the challenges of producing media in an industry context. Meets with CMS.610 but assignments differ.
Fall: J. Green
Spring: C. Weaver

CMS.925 Film Music
(Subject meets with 21M.284)
Prereq: Permission of instructor
G (Spring)
3-3-6
Meets with 21M.284, but assignments differ.
M. Marks

CMS.930 Documentary Photography and Photojournalism: Still Images of a World in Motion
(Subject meets with 21W.749)
Prereq: Permission of instructor
G (Spring)
3-0-9
Meets with 21W.749, but assignments differ.
B. D. Colen

CMS.950 Workshop I
Prereq: Permission of instructor
G (Fall)
3-3-6 H-LEVEL Grad Credit
Provides an opportunity for direct project development experience and emphasizes intellectual growth as well as the acquisition of technical skills. Students attend regular meetings to present and critique their work and discuss its implications.
N. Montfort

CMS.951 Workshop II
Prereq: CMS.950
G (Spring)
Units arranged H-Level Grad Credit
Students work on an individual project that can be presented for review as a portfolio. The portfolio can be a new project or an extension of work begun in the first term. Students attend regular meetings to present and critique their work and discuss its implications.
N. Montfort

CMS.965 Videogame Theory and Analysis
(Subject meets with CMS.865)
Prereq: —
G (Fall)
3-3-6
Introduction to the interdisciplinary study of commercial videogames as texts, examining their cultural, educational, and social functions in contemporary settings. Readings in educational theory and analysis of the conception and design of a videogame selected in consultation with the instructor. Graduate students complete additional assignments.
P. Tan
CMS.980 Master’s Thesis
Prereq: Permission of advisor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Completion of a graduate thesis, to be arranged with a faculty member, who becomes the thesis supervisor. Required of all CMS students.
Staff

CMS.990 Colloquium in Comparative Media
Prereq: —
G (Fall, Spring)
2-0-1 [P/D/F]
Can be repeated for credit
Exposes students to the perspectives of scholars, activists, mediakuners, policymakers, and industry leaders on cutting edge issues in media. Registered CMS graduate students only.
Staff

CMS.992 Portfolio in Comparative Media
Prereq: CMS.950 or permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged
Students work individually with an advisor to produce a portfolio project which combines technical skills and a substantial intellectual component. This subject can fulfill the second part of the workshop requirement for CMS graduate students.
Staff

CMS.993 Teaching in Comparative Media
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
For qualified graduate students interested in teaching. Offers experience in classroom and/or tutorial teaching under the supervision of a Comparative Media Studies faculty member.
Staff

CMS.994 Topics in Comparative Media Studies
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
Units arranged
Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.
Staff

CMS.995 Research in Comparative Media
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for independent study or research in comparative media studies under the supervision of a member of the Program.
Staff

CMS.996 Topics in Comparative Media Studies
Prereq: —
G (Fall, Spring)
Units arranged
Can be repeated for credit
Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.
Staff

CMS.997 Topics in Comparative Media
Prereq: —
G (Fall, Spring)
9-3-0
Can be repeated for credit
Discussion of current-interest special topics not otherwise included in the curriculum. Undergraduates should register for CMS.602. Topic for fall 2007: Television Ecosystem. Fall: S. Schulman, A. Chisholm Spring: J. Green

CMS.998 Topics in Comparative Media
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged
Can be repeated for credit
Supplementary work on an individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff. Undergraduates should register for CMS.600. Topic for fall 2007: Videogame Theory. Topic for spring 2008: New Media Literacies. A. Robison

CMS.999 Topics in Comparative Media
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged
Can be repeated for credit
Supplementary work on an individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff. Undergraduates should register for CMS.601. Topic for fall 2007 and spring 2008: Character Design and World Making. F. Espinosa

Subject CMS.880 to CMS.999

2007–2008
CSB.100J Topics in Computational and Systems Biology
(Same subject as 7.89J)
Prereq: Permission of instructor
G (Fall)
2-0-10 H-LEVEL Grad Credit
Seminar based on research literature. Papers covered are selected to illustrate important problems and different approaches in the field of computational and systems biology, and provide students a framework from which to evaluate new developments. Required of, and restricted to, first-year CSB PhD students.
C. Burge

CSB.110 Research Rotations in Computational and Systems Biology
Prereq: Permission of instructor
G (Fall, Spring)
0-12-0 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Students carry out research rotations with MIT faculty members or principal investigators working in the field of computational and systems biology. Generally three one-month long rotations are pursued that together span theoretical and experimental approaches. Open only to CSB PhD students.
Staff

CSB.190 Research Problems in Computational and Systems Biology
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Directed research in the field of computational and systems biology. Open only to CSB PhD students.
Staff

CSB.THG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of SM or PhD thesis; to be arranged by the student and the MIT faculty advisor.
Information: Faculty Advisor
entrepreneurial failures in engineering (same subject as 1.588j, 3.070j, 22.002j, 21w.781j)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
See description under subject 21W.781j.
T. Eagar, W. Haas, A. Kadak, P. Lagacé

Esd.035j engineering design and rapid prototyping (New)
(Same subject as 16.810j)
Prereq: 16.01, 16.02 or 2.001, 2.002 or permission of instructor
U (IAP)
2-4-0
See description under subject 16.810j.
O. de Weck

Esd.04 frameworks and models in engineering systems
Prereq: 18.02
U (Spring)
3-0-9
Introduction to quantitative models and qualitative frameworks for studying complex engineering systems. The art of abstracting a complex system into a model for purposes of analysis and design while dealing with complexity, emergent behavior, stochasticity, non-linearities and the requirements of many stakeholders with divergent objectives. Architectural system configuration. Semester-long class project deals with critical contemporary issues which require an integrative, interdisciplinary approach using the above models and frameworks.
J. Sussman

Esd.053j chemicals in the environment: epidemiology, toxicology, and public health
(Same subject as 1.081j, 20.104j)
Prereq: 5.112 or 3.091; 7.012, 7.013, 7.014, or 7.015
U (Spring)
4-0-8
See description under subject 20.104j.
W. Thilly

TECHNOLOGY AND POLICY

Esd.10 introduction to technology and policy
Prereq: permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Frameworks and Models for Technology and Policy students explore perspectives in the policy process — agenda setting, problem definition, framing the terms of debate, formulation and analysis of options, implementation and evaluation of policy outcomes using frameworks including economics and markets, law, and business and management. Methods include cost/benefit analysis, probabilistic risk assessment, and system dynamics. Exercises include developing skills to work on the interface between technology and societal issues; simulation exercises; case studies; and group projects that illustrate issues involving multiple stakeholders with different value structures, high levels of uncertainty, multiple levels of complexity; and value trade-offs that are characteristic of engineering systems. Emphasis on negotiation, team building and group dynamics, and management of multiple actors and leadership.
A. Weigel

Esd.103j science, technology, and public policy
(Same subject as 17.310j, STS.482j)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 17.310j.
K. Oye

Esd.123j industrial ecology
(Same subject as 1.814j, 3.560j)
Prereq: Esd.10 or 3.56
G (Spring)
3-0-6 H-LEVEL Grad Credit
Quantitative techniques for life cycle analysis of the impacts of materials extraction, processing use, and recycling; and economic analysis of materials processing, products, and markets. Student teams undertake a major case study of automobile manufacturing using the latest methods of analysis and computer-based models of materials process.
R. Kirchain, J. Clark, F. Field

Esd.126 energy systems and economic development
Prereq: Esd.10
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
A team-based policy research subject focused on evaluation of energy technologies and their implementation within developing countries. Focuses on one or more specific nations, carries out a resource assessment, and develops an energy strategy that is congruent with technical potential, cultural requirements, and environmental constraints.
R. D. Tabors, Staff

Esd.128j global climate change: economics, science, and policy
(Same subject as 12.848j, 15.023j)
Prereq: 18.02; 5.60 or 2.005; 15.010
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 15.023j.
H. D. Jacoby, R. G. Prinn
ESD.129| Space Policy Seminar
(Same subject as 16.891J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-7 H-LEVEL Grad Credit
See description under subject 16.891J.
J. A. Hoffman

ESD.132| Law, Technology, and Public Policy
(Same subject as 15.655J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Examination of the relationship between law and technological change, and the ways in which law, economics, and technological change shape public policy. Areas addressed include how law can be used to influence and guide technological change; responses of the legal system to environmental, safety, social and ethical problems created by new or existing technology; how law and markets interact to limit or encourage technological development; and how law can affect the distribution of wealth and social justice. Topics covered include genetic engineering; telecommunications; industrial automation; the effect of health, safety, and environmental regulation on technological innovation; the impacts of intellectual property law on innovation and equity; pharmaceuticals; nanotechnology; cost/benefit analysis as a decision tool; public participation in governmental decisions affecting science and technology; and law and economics as competing paradigms to encourage sustainability.
N. A. Ashford, C. C. Caldart

ESD.133| Environmental Law, Policy, and Economics: Pollution Prevention and Control
(Same subject as 1.811J, 11.630J)
Prereq: Permission of instructor for undergraduates
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.811J.
N. A. Ashford, C. C. Caldart

ESD.134| Regulation of Chemicals, Radiation, and Biotechnology
(Same subject as 1.812J, 11.631J)
(Subject meets with I.802J, 11.022J)
Prereq: Permission of instructor for undergraduates
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.812J.
N. A. Ashford, C. C. Caldart

ESD.136| Technology, Law, and the Working Environment
(Same subject as 10.805J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 10.805J.
N. A. Ashford, C. C. Caldart

ESD.137| Sustainability, Trade, and the Environment
(Same subject as 1.813J, 11.466J, 15.657J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
The Schumpeterian notion of technological innovation as “the engine of growth” is being challenged as the globalization of trade is increasingly seen as the driving force of industrial economies. With the establishment of the World Trade Organization implementing the GATT, NAFTA, and other trading regimes, serious questions have been raised concerning the effects of global trade on sustainability, which must be viewed broadly to include not only a healthy economic base, but also a sound environment, stable employment, adequate purchasing power, distributional equity, national self-reliance, and maintenance of cultural integrity. Subject explores the many dimensions of sustainability and the use of national, multinational, and international political and legal mechanisms to further sustainable development.
N. A. Ashford

ESD.141| Technology Negotiations and Dispute Resolution Systems
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-3 H-LEVEL Grad Credit
Focuses on technology, policy and logistics negotiations, as well as the associated dispute resolution systems. Emphasis on key interactive skills and analytic competencies. Field projects examine dispute resolution systems in organizational and institutional settings. Oriented for students in the technology policy program and the MEng in logistics program. Restricted to students in the LFM, SDM, TPP, MLOG, and ESD SM programs, except by permission of instructor. Half-term subject offered second half of term.
J. Cutcher-Gershenfeld

ESD.151| Chemicals in the Environment: Fate and Transport
(Same subject as 1.725J)
Prereq: Permission of instructor
G (Fall)
3-0-9
See description under subject 1.725J.
R. Shanahan

ESD.163| Managing Nuclear Technology
(Same subject as 22.812J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 22.812J.
R. K. Lester

ESD.166| Sustainable Energy
(Same subject as 1.818J, 2.65J, 10.391J, 11.371J, 22.811J)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject 10.391J.
M. W. Golay, J. W. Tester, J. P. Freidberg

ESD.174| Applications of Technology in Energy and the Environment
Engineering School-Wide Elective Subject.
(Offered under: 1.149, 2.63, 5.00, 10.579, 22.813, ESD.174)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 22.813.
J. Deutch, R. Lester

ESD.191| Cities and Regions: Urban Economics and Public Policy
(Same subject as 1.283J, 11.401J, 14.573J)
Prereq: 14.03 or 14.04
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 14.573J.
W. Wheaton

ESD.192| Analyzing and Accounting for Regional Economic Change
(Same subject as 1.284J, 11.481J)
Prereq: 14.03, 14.04
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 11.481J.
K. R. Polenske
TRANSPORTATION

ESD.21j Transportation Systems Analysis
(Same subject as 1.200, 11.544)
Prereq: 1.101 and permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit
See description under subject 1.200.
C. Barnhart, A. R. Odoni

ESD.210j Introduction to Transportation Systems
(Same subject as 1.201, 11.545)
Prereq: Permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit
See description under subject 1.201.
J. Sussman, N. H. M. Wilson

ESD.212j Demand Modeling
(Same subject as 1.202)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
M. E. Ben-Akiva

ESD.213j Advanced Demand Modeling
(Same subject as 1.205)
Prereq: 1.202 or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 1.205.
M. E. Ben-Akiva

ESD.215j Airline Schedule Planning
(Same subject as 1.206, 16.777)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.206.
C. Barnhart

ESD.216j Logistical and Transportation Planning Methods
(Same subject as 1.203, 6.281j, 15.073j, 16.76j)
Prereq: 6.431
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.203.
R. C. Larson, A. R. Odoni, A. I. Barnett

ESD.217j The Airline Industry
(Same subject as 1.232j, 15.054j, 16.71j)
Prereq: —
G (Fall)
3-0-9
See description under subject 16.71j.
P. P. Belobaba, A. I. Barnett, C. Barnhart,
R. J. Hansman, T. A. Kochan, A. R. Odoni

ESD.221j An Introduction to Intelligent Transportation Systems
(Same subject as 1.212j)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 1.212j.
J. Sussman

ESD.222j Transportation Policy and Environmental Limits
(Same subject as 1.253j, 11.543j)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.253j.
J. Coughlin, F. Salvucci

ESD.224j Planning and Design of Airport Systems
(Same subject as 1.231j, 16.781j)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 1.231j.
R. de Neufville, A. R. Odoni

ESD.225j Urban Transportation Planning
(Same subject as 1.252j, 11.540j)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 11.540j.
F. Salvucci, M. Murga

ESD.226j Public Transportation Systems
(Same subject as 1.258j, 11.541j)
Prereq: 1.201j or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.258j.
N. H. M. Wilson

ESD.229j Urban Spatial Structure, Transportation, and Telecommunications I
(Same subject as 11.528j)
Prereq: 11.204 or permission of instructor
G (Spring)
3-1-2 H-LEVEL Grad Credit
See description under subject 11.528j.
Staff

ESD.260j Logistics Systems
(Same subject as 1.260j, 15.770j)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to supply chain management from both analytical and practical perspectives. Stressing a unified approach, the course allows the student to develop a framework for making intelligent decisions within the supply chain. Key logistics functions are covered to include demand planning, procurement, inventory theory and control, transportation planning and execution, reverse logistics, and flexible contracting. Concepts explored include postponement, portfolio management, dual sourcing, and others. Emphasis is placed on being able to recognize and manage risk, analyze various tradeoffs, and model logistics systems.
Y. Sheffi, C. Caplice

ESD.261j Case Studies in Logistics and Supply Chain Management
(Same subject as 1.261j, 15.771j)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
A combination of lectures and cases covering the strategic, management, and operating issues in contemporary logistics and integrated supply chain management. Includes: logistics strategy; supply chain restructuring and change management; and distribution, customer service, and inventory policy.
J. Byrnes
**ESD.262J Supply Chain Context**
(Same subject as 1.262J)
Prereq: ESD.260 or permission of instructor
G (IAP)
2-0-4 [P/D/F]
Introduction to theory and practice of the core functions of the enterprises that impact supply chain management. Provides a basic understanding of strategy, industry structure, organization behavior, and marketing highlighted in the context of the supply chain. Uses lectures to introduce core functions and cases to illustrate the relationship and context for supply chain management. This results in a basic tool set to illustrate the theory and practice of analyzing and managing the relationship between supply chain management and the various functions of business. Also provides a solid understanding of supply chain management in practice. Core subject for MEng in Logistics.

C. Caplice, J. Goentzel

**ESD.263 Logistics Thesis Seminar**
Prereq: —
G (Fall)
2-0-1 [P/D/F]
The thesis process, technical writing, and presentation skills. Seminar organizes students into groups working on parallel topics. Half-term subject offered in the second half of the term. Limited to MEng in Logistics students.

Y. Sheffi, C. Caplice

**ESD.264J Database, Internet, and Systems Integration Technologies**
(Same subject as 1.264J)
Prereq: Permission of instructor
G (Fall)
4-1-7 H-LEVEL Grad Credit

See description under subject 1.264J.

G. Kocur

**ESD.265J International Supply Chain Management**
(Same subject as 1.265J, 2.965J, 15.765J)
Prereq: ESD.260J, 1.261J, 1.262J, 15.760, or permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit

See description under subject 2.965J.

H. S. Marcus, A. Weiss

**ESD.267J Supply Chain Planning**
(Same subject as 1.273J, 15.762J)
Prereq: 1.260J, 15.760, or 15.761
G (Spring)
2-0-4 H-LEVEL Grad Credit
See description under subject 15.762J.

S. C. Graves, D. Simchi-Levi

**ESD.268J Manufacturing System and Supply Chain Design**
(Same subject as 1.274J, 15.763J)
Prereq: 1.260, 15.760, or 15.761
G (Spring)
2-0-4 H-LEVEL Grad Credit
See description under subject 15.763J.

S. C. Graves, D. Simchi-Levi

**ESD.270 Studies in Transportation**
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Individual advanced study of a topic in transportation systems, selected with the approval of the instructor.

Staff

**ESD.271 Research Seminar in Transportation**
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Discussion of current research at various stages of development, including problem definition, literature review, methodology, and evaluation of results. Intended for advanced doctoral students who have passed the general examination.

Staff

**ESD.272J Design and Operation of Logistics Facilities and Networks**
(Same subject as 1.272J)
Prereq: 1.260J or permission of instructor
G (IAP)
2-0-1

Exploration of the technological and managerial issues involved in the design and operation of distribution and logistics physical facilities and associated information technology in an enterprise wise supply chain. Includes day-long site visits to logistics operations in the local area, as well as day-long software tutorials on commercial-grade software packages used in the design of logistics networks. The curriculum also includes lectures and case studies from faculty and professional logistics consultants focusing on the design and operation of efficient logistics facilities.

C. Caplice

**ESD.273J Logistics and Supply Chain Management**
(Same subject as 1.270J)
Prereq: Probability and Linear Programming
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Survey of operations research models and techniques developed for a variety of problems arising in logistical planning of multi-echelon systems. Focus on planning models for production/inventory/distribution strategies in general multi-echelon multi-item systems. Topics include vehicle routing problems, dynamic lot sizing inventory models, stochastic and deterministic multi-echelon inventory systems, the bullwhip effect, pricing models, and integration problems arising in supply chain management.

D. Simchi-Levi

**ESD.290 Special Topics in Supply Chain Management**
Prereq: ESD.260J, 1.260J, 15.770J, or permission of instructor
G (Spring)
3-0-3 H-LEVEL Grad Credit
Presents a range of advanced topics in integrated logistics and supply chain management. Conducted in a lecture-discussion format, with participation of corporate executives as guest lecturers. Students prepare industry assessment analyses and make formal classroom presentations. Specific topics alternate from year to year, but basic content includes procurement strategies and strategic sourcing, dynamic pricing and revenue management tactics, mitigation of supply chain risk through supply contracts, strategic outsourcing of supply chain functions and operations, management and operation of third party logistics providers, and management of supply chain security.

Y. Sheffi

**SYSTEMS DESIGN AND MANAGEMENT**

**ESD.30J Engineering Apollo: The Moon Project as a Complex System**
(Same subject as 16.895J, STS.471J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject STS.471J.

D. Mindell, L. R. Young
ESD.301 Probability and Statistics (New)
Prereq: —
G (IAP)
1-0-3 [P/D/F]
A highly condensed review of topics from basic probability through calculus-based statistical analysis. It assumes previous probability and statistics course work, and is designed to be an intensive review for incoming SDM students. Limited to SDM students except by permission of instructor.
J. Orloff

ESD.32J Product Design and Development
(Same subject as 2.739J, 15.783J)
Prereq: 2.009, 15.760, 15.761, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 15.783J).
W. P. Seering

ESD.33 Systems Engineering
Prereq: Limited to SDM students except by permission of instructor
G (Summer)
2-1-6 H-LEVEL Grad Credit
Credit cannot also be received for 16.880
Systems engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem including operations, performance, test, manufacturing, cost, and schedule. This subject emphasizes the links of systems engineering to fundamentals of decision theory, statistics, and optimization. Also introduces the most current, commercially successful techniques for systems engineering.
K. Katsikopoulos

ESD.34 System Architecture
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Covers principles and methods for technical system architecture. Presents a synthetic view including: the resolution of ambiguity to identify system goals and boundaries; the creative process of mapping form to function; and the analysis of complexity and methods of decomposition and re-integration. Industrial speakers and faculty present examples from various industries. Heuristic and formal methods are presented. Restricted to SDM students.
E. F. Crawley

ESD.341J Web System Architcting: Building Web Services
(Same subject as 1.125J)
Prereq: 1.124J, 6.001
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 1.125J.
J. R. Williams

ESD.342 Advanced System Architecture
Prereq: ESD.83, ESD.84, or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Focus on deep understanding of engineering systems at a level intended for research on complex engineering systems. Review and extension of what is known about system architecture and complexity from a theoretical point of view while examining the origins of and recent developments in the field. Studies how and where the theory has been applied, and uses key analytical methods proposed. Examine the level of observational (qualitative and quantitative) understanding necessary for successful use of the theoretical framework for a specific engineering system. Case studies utilized to apply the theory and principles to engineering systems.
C. Magee, J. Moses, D. Whitney

ESD.35J Aircraft Systems Engineering
(Same subject as 16.885J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit
See description under subject 16.885J.
R. J. Hansman, A. Haggerty, R. Liebeck

ESD.352J Space Systems Engineering
(Same subject as 16.89J)
Prereq: 16.851, 16.892, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
4-6-2 H-LEVEL Grad Credit
See description under subject 16.89J.
E. F. Crawley, J. A. Hoffman

ESD.353J Space System Architecture and Design
(Same subject as 16.892J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-7 H-LEVEL Grad Credit
See description under subject 16.892J.
D. E. Hastings

ESD.355J Concepts in the Engineering of Software
(Same subject as 16.35J)
Prereq: 16.35, 16.880J/ESD.33J, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 16.35J.
N. G. Leveson

ESD.36 System Project Management
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Focuses on management principles, methods, and tools to effectively plan and implement successful system and product development projects. Material is divided into four major sections: project preparation, planning, monitoring, and adaptation. Brief review of classical techniques such as CPM and PERT. Emphasis on new methodologies and tools such as Design Structure Matrix, probabilistic project simulation, as well as project system dynamics. Topics are covered from strategic, tactical, and operational perspectives. Industrial case studies expose factors that are typical drivers of success and failure in complex projects with both hardware and software content. Term projects analyze and evaluate past and ongoing projects in student’s area of interest. Projects used to apply concepts discussed in class.
D. de Weck, J. Lyneis

ESD.37 The Human Side of Technology
Prereq: Permission of instructor
G (IAP)
2-1-6
Examines the human side of managing and leading technical professionals and project teams throughout the innovation process. Covers both micro (individual and group) and macro issues (organizational structure, culture, and interfunctional relationships). Topics include creating and sustaining the motivational commitment and performance of professional employees over time; dealing with complacency and routine performance; understanding the interrelation-
ships among innovation, change, motivation and uncertainty; managing creative individual contributors in team settings; managing reward systems and career paths of professionals; leading decision making processes and effective conflict management; staffing and managing the critical roles and cross-functional relationships for building high commitment cultures and streams of innovation; managing communications and the effective transfer of knowledge and information across organizational structures; and organizational diagnosis for change. Restricted to SDM students; others with permission of instructor.

**Staff**

**ESD.379 Systems Engineering Taxonomy and Semantics in Commercial Domains (New)**
Prereq: —
G (Fall, Spring)
1-0-3 [P/D/F]

The application of systems engineering practices is increasing in commercial enterprises, but the semantics and process frameworks for “commercial systems engineering” often appear to be quite different from the process and taxonomy developed in defense and aerospace, arguably the birthplace of modern systems engineering. Examines how systems engineering practices are employed in commercial industries, including product and service development and delivery. Special project. Enrollment limited to five students.
P. Hale

**ESD.38J Enterprise Architecting**
(Same subject as 16.855J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Topics in architecting holistic and highly networked enterprise structures including: organizational structure; business models; organizational culture/behavior; enterprise architecture frameworks and standards; policy and process infrastructure; information technologies; and knowledge management. Explores how the practices and heuristics of systems architecting may be extended and adapted for enterprise architecting, along with discussions of evolving methods and toolsets.
D. Nightingale, D. Rhodes

**ESD.40J Product Design and Development**
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Modern tools and methods for product design and development. Teams of SDM and certificate program students conceive, design, and prototype a physical product. Cases and exercises reinforce key ideas. Topics include product planning, identifying customer needs, concept generation, product architecture, industrial design, concept design, and design-for-manufacturing. Restricted to SDM students or permission of instructor.
D. Whitney, P. Hale

**ESD.41 Infrastructure Systems**
Prereq: Permission of instructor
G (Fall)
2-0-4
Can be repeated for credit

Examination of networked infrastructure systems from different sectors including land transport, air transport, electric power and communications. Development of generalizable frameworks, analysis approaches and methodologies for infrastructure planning, design and operation that provide improved flexibility, safety, security, robustness, and operational efficiency.
R. J. Hansman, D. Roos

**TECHNOLOGY**

**ESD.51J Foundations of Software Engineering**
(Same subject as 1.124J, 2.091J)
Prereq: 1.00 or knowledge of an object-oriented language
G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject 1.124J.
J. R. Williams

**ESD.52J Introduction to the History of Technology**
(Same subject as STS.340J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

See description under subject STS.340J.
D. Mindell

**ESD.55 Management of Infrastructure Systems (New)**
Prereq: Preparation in infrastructure systems/control theory/system dynamics/network analysis or permission of instructor
Acad Year 2007–2008: Not offered
G (Fall)
3-0-6 H-Level Grad Credit

Infrastructure systems, such as transportation, telecommunication, and electric power systems, have become a crucial aspect of modern society. This course will investigate techniques from control theory and optimization that help develop and manage these systems. Although each system has unique features that need to be understood, we will see how some tools have general applicability. The course will study concepts such as stability, robustness, resource allocation, stakeholder equity, and arguments for centralization/decentralization of components.
H. Balakrishnan

**ESD.56J Integrating Information Systems: Technical, Strategic, and Organizational Factors**
(Same subject as 15.565J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

See description under subject 15.565J.
S. Madnick

**ESD.57 Technology Advances, Business Transformation and Innovation (New)**
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

How to leverage major technology advances to significantly transform a business in the marketplace. Focus on major issues a business must deal with to transform its technical and market strategies successfully, including the organizational and cultural aspects that often cause such business transformations to fail. Draws from concrete experiences of IBM’s major transformation in the late 1990s, when it aggressively embraced the Internet and came up with its e-business strategy. Limited to 15 students.
I. Wladawsky-Berger

**ESD.58J Disruptive Technologies: Predator or Prey?**
(Same subject as 15.365J)
Prereq: —
G (Spring)
3-0-6

See description under subject 15.365J.
J. M. Utterback

**ESD.60 Lean/Six Sigma Processes**
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Summer)
2-0-4

Addresses forces driving lean/six sigma, lean thinking, variance reduction, design of experiments, (pre-stability) factors, team-based work systems, in-station process control, total productive maintenance, synchronous material
flow, value stream mapping, knowledge and information flow, pull-based systems in contrasting industry settings, and enterprise alignment. Emphasis on bold visions and harsh realities. Restricted to Leaders for Manufacturing students. 

J. Cutcher-Gershenfeld

**ESD.61J Integrating The Lean Enterprise**
(Same subject as 16.852J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 16.852J.
D. Nightingale

**ESD.63J Control of Manufacturing Processes**
(Same subject as 2.830J, 6.780J)
Prereq: 2.08, 2.810, 2.751J, 6.152J, or 6.041G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.830J.
D. E. Hardt, D. S. Boning

**ESD.64J Product Design**
(Same subject as 2.744J)
Prereq: 2.009
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit
See description under subject 2.744J.
D. R. Wallace

**ESD.65J Aerospace Biomedical and Life Support Engineering**
(Same subject as 16.423J, HST.515J)
Prereq: 16.400, 16.06, 16.060, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit
See description under subject 16.423J.
D. J. Newman

**ESD.66J Receivers, Antennas, and Signals**
(Same subject as 6.661J)
Prereq: 6.013 or 8.03; 6.003, 16.04, or 2.004
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 6.661J.
D. H. Staelin

**ESD.68 Communications and Information Policy**
Prereq: ESD.10 or permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit

Introduction to the technology and policy context of public communications networks. Critical discussion of current issues in communications policy and their historical roots. Focuses on underlying rationales and models for government involvement and the complex dynamics introduced by co-evolving technologies, industry structure, and public policy objectives. Cases drawn from cellular, fixed-line, and Internet applications include evolution of spectrum policy and current proposals for reform; the migration to broadband and implications for universal service policies; and property rights associated with digital content. Lays foundation for thesis research in this domain.

_F. R. Field, D. D. Clark, W. H. Lehr_

**METHODS**

**ESD.70J Engineering Economy Module**
(Same subject as 1.145J)
Prereq: —
1-0-2 [P/D/F]

Presentation of the spreadsheet mechanics for the efficient calculation of discounted cash flows and related metrics of project worth; the use of data tables as means of exploring sensitivity analysis; and of simulation to develop the value of options. Intensive module designed for students who are not familiar with the efficient use of this Excel. Half-term subject offered in first half of term.

*R. de Neufville, Staff*

**ESD.71 Engineering Systems Analysis for Design**
Engineering School-Wide Elective Subject.
(Offered under: 1.146, 3.56, 16.861, ESD.71)
Prereq: 1.145J or permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Engineering systems design must have the flexibility to take advantage of new opportunities while avoiding disasters. Subject develops “real options” analysis to create design flexibility and measure its value so that it can be incorporated into system optimization. Subject builds on essential concepts of systems models, decision analysis, and financial concepts. Emphasis on calculating value of real options with special attention given to efficient analysis and practical applications. The material is organized and presented to deal with the contextual reality of technological systems, that substantially distinguishes the analysis of real options in engineering systems from that of financial options.

*R. de Neufville*

**ESD.72 Engineering Risk-Benefit Analysis**
Engineering School-Wide Elective Subject.
(Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit

Emphasis on three methodologies pertaining to decision making in the presence of uncertainty: reliability and probabilistic risk assessment, decision analysis, and cost-benefit analysis. Risks of particular interest are those associated with large engineering projects such as the development of new products; the building, maintenance and operation of nuclear reactors and space systems. Presents and interprets some of the frameworks helpful for balancing risks and benefits in the situations that typically involve human safety, potential environmental effects, and large financial and technological uncertainties. Review of elementary probability theory and statistics included.

G. E. Apostolakis

**ESD.721 Engineering Risk-Benefit Analysis**
(Abridged)
Prereq: 18.02
G (Spring)
3-0-6 H-LEVEL Grad Credit

Abbreviated version of ESD.72 with which it shares the lectures on reliability and probabilistic risk assessment and decision analysis. Cost-benefit analysis is omitted.

G. E. Apostolakis

**ESD.73J Materials Selection, Design, and Economics**
(Same subject as 3.57J)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

See description under subject 3.57J.
J. Clark

**ESD.73J Materials Selection, Design, and Economics**
(Same subject as 3.575J)
Prereq: Permission of instructor
G (Summer)
2-0-4 H-LEVEL Grad Credit

A survey of techniques for analyzing how the choice of materials, processes, and design determine properties, performance, and cost.
Topics include production and cost functions, evaluation of single and multi-attribute utility, decision analysis, materials property charts, and performance indices. Students use analytical techniques to develop a plan for starting a new manufacturing-related business. Restricted to Leaders for Manufacturing students.

J. P. Clark

ESD.74 System Dynamics for Engineers
Prereq: Permission of instructor
G (Summer)
3-0-9 H-LEVEL Grad Credit
Introduces the methodology and then develops applications to large-scale engineering systems, such as the design and construction of mega projects; the impacts of organization on system performance; and the interrelationships between technical systems and the social/political context in which such systems operate.

J. Lyneis

ESD.750J System Optimization and Analysis for Manufacturing
(Same subject as 2.851J, 15.066J)
Prereq: 18.02
G (Summer)
4-0-8 H-LEVEL Grad Credit
See description under subject 15.066J.

S. C. Graves, J. P. Clark, J. Gallien

ESD.751J Engineering Probability and Statistics
(Same subject as 15.064J)
Prereq: 18.02
G (Summer)
4-0-8 H-LEVEL Grad Credit
See description under subject 15.064J.

A. I. Barnett, R. Welsch

ESD.753J Statistical Learning and Data Mining
(Same subject as 15.077J)
Prereq: 6.431J, 15.085J, or 18.440; 18.06 or 18.700
G (Spring)
4-0-8 H-LEVEL Grad Credit
See description under subject 15.077J.

R. E. Welsch

ESD.755J Statistical Reasoning and Data Modeling (New)
(Same subject as 15.074J)
Prereq: Permission of instructor
G (Fall)
4-0-8 H-LEVEL Grad Credit
See description under subject 15.074J.

R. E. Welsch

ESD.756J Statistical Methods in Experimental Design
(Same subject as 16.470J)
Prereq: 6.041 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 16.470J.

M. L. Cummings

ESD.762 Systems Optimization
Prereq: —
G (Spring)
2-0-4 H-LEVEL Grad Credit
Application-oriented introduction to systems optimization focusing on understanding system tradeoffs. Introduces modeling methodology (linear, integer and nonlinear programming) and simulation methods, with applications in production planning and scheduling, inventory planning and supply contracts, logistics network design, facility sizing and capacity expansion, yield management, electronic trading and finance.

Staff

ESD.763 Operations and Supply Chain Management
Prereq: Permission of instructor
G (Summer)
3-0-6 H-LEVEL Grad Credit
Objectives are to develop modeling skills and to provide new concepts and problem-solving tools, applicable to the design and planning of supply chains as well as manufacturing systems.

Staff

ESD.77J Multidisciplinary System Design Optimization
(Same subject as 16.888J)
Prereq: 18.085 or permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit

O. de Weck, K.E. Willcox

ESD.772J Quantitative Foundations of Engineering Systems
(Same subject as 6.282J)
Prereq: 6.041
G (Spring)
3-0-9 H-LEVEL Grad Credit
This interdisciplinary subject aims to teach quantitative principles of design and analysis of large complex engineering systems at the beginning graduate level. Topics include principles of modeling, systems design, control and performance analysis using ideas from control, optimization, algorithms and stochastic processes. Designed as more conceptual and less technical (mathematical), That is, use of mathematics (sometimes sophisticated) is taught but the detailed proofs are usually omitted. Concepts supported and explained with examples drawn from the Internet. Provides the necessary background for advanced subjects on foundations of engineering systems.

S. Mitter, D. Shah

ESD.78J Network Optimization
(Same subject as 6.855J, 15.082J)
Prereq: 6.046J, 6.251J, 15.081J, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 15.082J.

A. S. Schulz

ESD.79J Quantum Computation
(Same subject as 2.111J, 18.435J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 18.435J.

E. Farhi, S. Lloyd, P. Shor

PROFESSIONAL DEVELOPMENT

ESD.80 Seminar in Technology Policy Research
Prereq: ESD.10
G (Spring)
2-0-1 H-LEVEL Grad Credit
Presentations by students, faculty and guest speakers of ongoing research related to current issues in technology and policy. Specific topics determined by research of participants and by
new and important directions in technology and policy.
R. Kirchain

ESD.801 Leadership Development
Prereq: Permission of instructor
G (Fall)
1-1-1 [P/D/F]
Seminar environment created to develop leadership capabilities. An initial Outward Bound experience builds trust, teamwork and communications. Readings and assignments emphasize the characteristics of great leadership. Global leaders participate in the Leadership Lunch series to share their experiences and recommendations. Discussions explore leadership development. Culminates in a personal leadership plan. Restricted to entering students in the Technology and Policy program or instructor permission.  
D. Newman

ESD.802 SDM Thesis Seminar
Prereq: Permission of instructor
G (Spring)
2-0-1 [P/D/F] H-LEVEL Grad Credit
Designed to assist SDM students in discovering research areas of interest and matching these interests with faculty and organization research projects. At the end of the seminar, the student has faculty advisor, research project, thesis proposal and plan. Restricted to SDM students.  
P. Hole

ESD.803 Know Thyself Leadership Workshop
Prereq: —
G (Fall)
2-0-4
Designed to enhance your ability to manage and lead in challenging times through a series of self assessment instruments, case studies, and workshops. The objectives are to increase awareness of your strengths and weaknesses as a leader, provide a battery of instruments and surveys to help one understand the way one operates in a personal leadership setting. Restricted to students in the MLOG program; others with permission of instructor.  
Information: C. Caplice

ESD.81 Studies in Transportation and Logistics
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Individual advanced study of a topic in logistics systems selected with the approval of the instructor.  
Staff

ESD.811 Technology Policy Internship Seminar
Prereq: ESD.10
G (Fall)
1-1-1 [P/D/F] H-LEVEL Grad Credit
Seminar examines what technology policy is in practice. Considers the question of “Who achieves what, when, how, and why?” regarding technology policy. Students who completed summer internships present and dissect their experiences with special reference to specific cases in which they participated.  
F. Field

ESD.83 Doctoral Seminar in Engineering Systems
Prereq: ESD.10 or permission of instructor
G (Fall)
6-0-6 H-LEVEL Grad Credit
Examines core theory and contextual applications of the emerging field of Engineering Systems. Focus on doctoral-level analysis of scholarship on key concepts such as complexity, uncertainty, fragility, and robustness, as well as a critical look at the historical roots of the field and related areas such as systems engineering, systems dynamics, agent modeling, and system simulations. Contextual applications range from aerospace to technology implementation to regulatory systems to large-scale systems change. Special attention given to the interdependence of social and technical dimensions of engineering systems. Restricted to students enrolled in doctoral programs.  
C. Magee, J. Carroll, R. Larson, D. H. Marks

ESD.832 Mining Data, Modeling Systems, Making Impact
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Seminar on modeling engineering-economic systems for real-world applications. Successful applications require data analysis, systems modeling and judgment of importance. Introduction to data mining techniques and software. Cases of real world applications of systems models used to demonstrate the art.  
R. C. Larson, N. Patel

ESD.85J Integrating Doctoral Seminar on Emerging Technologies
(See description under subject 17.312, STS.461J)
Prereq: Permission of instructor
G (Spring)
2-0-7 H-LEVEL Grad Credit
Team-taught subject for doctoral students working on emerging technologies at the interface of technology, policy and societal issues. Integrates concepts of research strategy and design from a variety of disciplines. Addresses problem identification and formulation of research topics, the role of qualitative and quantitative research methods, and the use of various data collection techniques. Focuses on students’ thesis proposals, faculty-student study panels, critical evaluation of research design, and ethical issues in conducting research and gathering data.  
K. Oye

ESD.86 Models, Data and Inference for Socio-Technical Systems
Prereq: ESD.83, 6.041 or permission of instructor
G (Spring)
3-0-9
Use data and systems knowledge to build models of complex socio-technical systems for improved system design and decision-making. Enhance model-building skills, including: review and extension of functions of random variables, Poisson processes, and Markov processes. Move from applied probability to statistics via Chi-squared t and f tests, derived as functions of random variables. Review classical statistics, hypothesis tests, regression, correlation and causation, simple data mining techniques, and Bayesian vs. classical statistics. Class project. Enrollment limited to 25 students.  
R. C. Larson, D. D. Frey

ESD.863] System Safety
(See description under subject 16.863J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 16.863J.
N. G. Leveson

ESD.875] Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development
(See description under subject 2.875J)
Prereq: 2.008
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.875J.
D. E. Whitney
SPECIAL SUBJECTS

ESD.910–ESD.920 Research in Engineering Systems Division
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
For research assistants in the Engineering Systems Division when assigned research is not used for thesis, but is approved for academic credit. Credit for this subject may not be used for any degree granted by ESD. Information: R. de Neufville

ESD.921–ESD.929 Teaching in Engineering Systems Division
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
For teaching assistants in Engineering Systems Division in recognition of educational value derived from satisfactory performance of assigned duties, and for other qualified students interested in teaching as a career. Laboratory, tutorial, or classroom teaching under supervision of a faculty member. Credit for this subject may not be used for any degree granted by ESD. Information: R. de Neufville

ESD.930–ESD.933 Special Graduate Studies in Engineering Systems Division
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

ESD.934–ESD.939 Special Graduate Studies in Engineering Systems Division
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

ESD.940–ESD.943 Special Graduate Studies in Engineering Systems Division
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

ESD.944–ESD.949 Special Graduate Studies in Engineering Systems Division
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for individual or group study of advanced topics in Engineering Systems Division not otherwise included in the curriculum at MIT.

ESD.950–ESD.951 Special Undergraduate Studies in Engineering Systems Division
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

ESD.955–ESD.956 Special Undergraduate Studies in Engineering Systems Division
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Opportunity for individual or group study of topics in Engineering Systems Division not otherwise included in the curriculum at MIT. Offerings are initiated by faculty on an ad-hoc basis subject to ESD approval. Information: R. de Neufville

ESD.ThG ESD Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research leading to the writing of an SM or PhD thesis to be arranged by the student with a member of the ESD faculty. A minimum of 24 thesis units are required for the SM degree. R. de Neufville
IMPORTANT NOTES regarding preclinical subjects (HST.011–HST.185 and HST.191):

Students not enrolled in an HST degree program may take preclinical subjects if space is available. Non-HST students are limited to one HST preclinical course and must provide justification for enrolling in this course. They must obtain permission from the course director and the Associate Master of HST at HMS.

These subjects are scheduled according to the Harvard Medical School academic calendar, which differs from the MIT calendar. Students whose graduation depends upon completing one or more of these subjects should take particular care regarding the schedule.

HST.011 Human Functional Anatomy
(Subject meets with HST.010)
Prereq: Permission of instructor
G (Fall)
3-11-10 H-LEVEL Grad Credit

Lectures, detailed laboratory dissections, and case studies provide a thorough exploration of the gross structure and function of the human body. Fundamental principles of bioengineering are employed to promote analytical approaches to understanding the body’s design. The embryology of major organ systems is presented, together with certain references to phylogenetic development, as a basis for comprehending anatomical complexity. Correlation clinics stress both normal and abnormal functions of the body and present evolving knowledge of genes responsible for normal and abnormal anatomy. Lecturers focus on current problems in organ system research. Only HST students may register under HST.010, graded P/D/F. Enrollment restricted to graduate students.

L. Gehrke

HST.021 Musculoskeletal Pathophysiology
(Subject meets with HST.020)
Prereq: Permission of instructor
G (IAP)
3-0-3 H-LEVEL Grad Credit

Growth and development of normal bone and joints, the process of mineralization, the biophysics of bone and response to stress and fracture, calcium and phosphate homeostasis and regulation by parathyroid hormone and vitamin D, and the pathogenesis of metabolic bone diseases and disease of connective tissue, joints, and muscles, with consideration of possible mechanisms and underlying metabolic derangements. Only HST students may register under HST.020, graded P/D/F. Enrollment is limited and only open to medical and graduate students.


HST.031 Human Pathology
(Subject meets with HST.030)
Prereq: Permission of instructor; 7.012, 7.013, 7.014, 7.015, 8.01, or 8.02
G (Fall)
4-4-8 H-LEVEL Grad Credit

Introduction to the functional structure of normal cells and tissues, pathologic principles of cellular adaptation and injury, inflammation, circulatory disorders, immunologic injury, infection, genetic disorders, and neoplasia in humans. Lectures, conferences emphasizing clinical correlations and contemporary experimental biology. Laboratories with examination of microscopic and gross specimens, and autopsy case studies emphasizing modern pathology practice. Only HST students may register under HST.030, graded P/D/F. Enrollment limited.

R. N. Mitchell

HST.035 Principles and Practice of Human Pathology
(Subject meets with HST.034)
Prereq: 7.01 and 7.05; or permission of instructor
G (Spring)
4-2-10 H-LEVEL Grad Credit

Provides a comprehensive overview of human pathology with emphasis on mechanisms of disease and modern diagnostic technologies. Topics include general mechanisms of disease (inflammation, infection, immune injury, transplantation, genetic disorders and neoplasia); pathology of lipids, enzymes, and molecular transporters; pathology of major organ systems; and review of diagnostic tools from surgical pathology to non-invasive techniques such as spectroscopy, imaging, and molecular markers of disease. The objectives of this subject are achieved by a set of integrated lectures and laboratories, as well as a student-driven term project leading to a formal presentation on a medical, socioeconomic, or technological issue in human pathology. Only HST students enrolled in specific degree programs may register under HST.034, graded P/D/F. Credit cannot also be received for HST.030, HST.031.

K. Badizadegan

HST.041 Mechanisms of Microbial Pathogenesis
(Subject meets with HST.040)
Prereq: 7.05 and permission of instructor;
7.012, 7.013, 7.014, or 7.015
G (Fall)
3-6-5 H-LEVEL Grad Credit

Deals with the mechanisms of pathogenesis of bacteria, viruses, and other microorganisms. Approach spans mechanisms from molecular to clinical aspects of disease. Topics selected for intrinsic interest and cover the demonstrated spectrum of pathophysiologic mechanisms. Only HST students may register under HST.040, graded P/D/F. Enrollment limited.

C. Crumpacker II, H. Simon

HST.061 Endocrinology
(Subject meets with HST.060)
Prereq: 7.05 and permission of instructor;
7.012, 7.013, 7.014, or 7.015
G (Spring)
6-0-6 H-LEVEL Grad Credit

Physiology and pathophysiology of the human endocrine system. Three hours of lecture and section each week concern individual parts of the endocrine system. Topics include assay techniques, physiological integration, etc. At frequent clinic sessions, patients are presented who demonstrate clinical problems considered in the didactic lectures. Only HST students may register under HST.060, graded P/D/F. Enrollment limited.

W. Kettyle
HST.071 Human Reproductive Biology
(Subject meets with HST.070)
Prereq: 7.012, 7.013, 7.014, or 7.015; 7.05, permission of instructor
G (Fall)
2-4-3 H-LEVEL Grad Credit

Lectures and clinical case discussions designed to provide the student with a clear understanding of the physiology, endocrinology, and pathology of human reproduction. Emphasis is on the role of technology in reproductive science. Suggestions for future research contributions in the field are probed. Students become involved in the wider aspects of reproduction, such as prenatal diagnosis, in vitro fertilization, abortion, menopause, contraception and ethics relating to reproductive science. Only HST students may register under HST.070, graded P/D/F.

H. Klapolz

HST.081 Hematology
(Subject meets with HST.080)
Prereq: 7.05 and permission of instructor
G (Spring)
3-6-4 H-LEVEL Grad Credit

An intensive survey of the biology, physiology, and pathophysiology of blood with systematic consideration of hematopoiesis, white blood cells, red blood cells, platelets, coagulation, plasma proteins, and hematologic malignancies. Emphasis given equally to didactic discussion and analysis of clinical problems. Meets second half of the term. Only HST students may register under HST.080, graded P/D/F. Enrollment limited.

D. J. Kuter, J. O. Jacobson, J. Bradner, R. Rosovsky

HST.091 Cardiovascular Pathophysiology
(Subject meets with HST.090)
Prereq: HST.030 or HST.031; permission of instructor
G (Spring)
3-3-9 H-LEVEL Grad Credit

Normal and pathologic physiology of the heart and vascular system. Emphasis includes hemodynamics, electrophysiology, gross pathology, and clinical correlates of cardiovascular function in normal and in a variety of disease states. Special attention given to congenital, rheumatic, valvular heart disease and cardiomyopathy. Only HST students may register under HST.090, graded P/D/F. Enrollment limited.

E. Edelman

HST.101 Respiratory Pathophysiology
(Subject meets with HST.100)
Prereq: 7.05; 8.01; permission of instructor; 7.012, 7.013, 7.014, or 7.015
G (Spring)
4-0-8 H-LEVEL Grad Credit

Lectures, seminars, and laboratories cover the histology, cell biology, and physiological function of the lung with multiple examples related to common diseases of the lung. A quantitative approach to the physics of gases, respiratory mechanics, and gas exchange is provided to explain pathological mechanisms. Use of medical ventilators is discussed in lecture and in laboratory experiences. For MD candidates and other students with background in science. Only HST students may register under HST.100, graded P/D/F. Enrollment limited.

J. Drazen, S. Loring, A. Malhotra

HST.111 Renal Pathophysiology
(Subject meets with HST.110)
Prereq: 7.05 and permission of instructor; 7.012, 7.013, 7.014, or 7.015
G (Spring)
4-0-8 H-LEVEL Grad Credit

Considers the normal physiology of the kidney and the pathophysiology of renal disease. Renal regulation of sodium, potassium, acid, and water balance are emphasized as are the mechanism and consequences of renal failure. Included also are the pathology and pathophysiology of clinical renal disorders such as acute and chronic glomerulonephritis, pyelonephritis, and vascular disease. New molecular insights into transporter mutations and renal disease are discussed. Only HST students may register under HST.110, graded P/D/F. Enrollment limited.

D. Brown, C. Coggins, H. Rennke, J. Bonventre

HST.121 Gastroenterology
(Subject meets with HST.120)
Prereq: 7.05; 8.01; permission of instructor; 7.012, 7.013, 7.014, or 7.015
G (Fall)
3-6-4 H-LEVEL Grad Credit

Presents the anatomy, physiology, biochemistry, biophysics, and bioengineering of the gastrointestinal tract and associated pancreatic, liver, and biliary systems. Emphasis on the molecular and pathophysiological basis of disease where known. Covers gross and microscopic pathological and clinical aspects. Formal lectures given by core faculty, with some guest lectures by local experts. Selected seminars conducted by students with supervision of faculty. Only HST students may register under HST.120, graded P/D/F. Enrollment limited.

M. C. Carey, D. C. Chung, R. T. Chung, J. N. Glickman

HST.131 Introduction to Neuroscience
(Subject meets with HST.130)
Prereq: Permission of instructor
G (Fall)
6-3-6 H-LEVEL Grad Credit

A comprehensive introductory course in neuroscience, exploring the brain on levels ranging from molecules and cells through neural systems, perception, memory, and behavior. Some aspects of clinical neuroscience, within neuropharmacology, pathophysiology, and neurology. Lectures are supplemented by conferences and labs. Labs review neuroanatomy at the gross and microscopic levels. Only HST students may register under HST.130, graded P/D/F. Enrollment limited to 50.

D. P. Corey

HST.140 Molecular Medicine
Prereq: 7.05
G (Fall)
2-0-4 P/D/F H-LEVEL Grad Credit

Conducted as a seminar to study a variety of human diseases and the underlying molecular, genetic, and biochemical basis for the pathogenesis and pathophysiology of the disorders. Lectures by faculty and seminars conducted by students, with tutorials and supervision by faculty. Patients presented when feasible. Appropriate for students who have had a course in biochemistry and/or molecular biology.


HST.147 Human Biochemistry and Metabolic Diseases
(Subject meets with HST.146)
Prereq: Permission of instructor
G (IAp)
3-0-3 H-LEVEL Grad Credit

First-year graduate level intensive subject in human biochemistry and physiological chemistry that focuses on intermediary metabolism, structures of key intermediates and enzymes important in human disease. Subject is divided into four areas: carbohydrates, lipids, amino acids and nucleic acids. The importance of these areas is underscored with examples from diseases and clinical correlations that are introduced by clinician-scientists. Only HST students may register under HST.146, graded P/D/F. Enrollment limited.

C. N. Serhan
HST.151 Principles of Pharmacology
(Subject meets with HST.150)
Prereq: 7.012, 7.013, 7.014, or 7.015; 7.05, 8.01
G (Spring)
3-0-9 H-LEVEL Grad Credit

An introduction to pharmacology. Topics include mechanisms of drug action, dose-response relations, pharmacokinetics, drug delivery systems, drug metabolism, toxicity of pharmacological agents, drug interactions, and substance abuse. Selected agents and classes of agents examined in detail. BEP students must register for HST.151 (graded) other HST students may register under HST.150 (P/D/F). Course follows HMS calendar. Restricted to HST MD, HST MEMP or HST BEP students.
C. Rosow, G. Forman, G. Strichartz

HST.161 Molecular Biology and Genetics in Modern Medicine
(Subject meets with HST.160)
Prereq: 7.012, 7.013, 7.014, or 7.015; 7.05
G (Fall)
6-0-6 H-LEVEL Grad Credit

Foundation for understanding the relationship between molecular biology, developmental biology, genetics, genomics, bioinformatics, and medicine. Develops explicit connections between basic research, medical understanding, and the perspective of patients. Principles of human genetics reviewed. Translation of clinical understanding into analysis at the level of the gene, chromosome and molecule; the concepts and techniques of molecular biology and genomics; and the strategies and methods of genetic analysis, including an introduction to bioinformatics. Extends beyond basic principles to current research activity in human genetics. Only HST students may register under HST.160 graded P/D/F.
M. Meyerson, D. Housman, A. Chess

HST.176 Cellular and Molecular Immunology
(Subject meets with HST.175)
Prereq: 7.05
G (Fall)
4-0-8 H-LEVEL Grad Credit

Covers cells and tissues of the immune system, lymphocyte development, the structure and function of antigen receptors, the cell biology of antigen processing and presentation including molecular structure and assembly of MHC molecules, lymphocyte activation, the biology of cytokines, leukocyte-endothelial interactions, and the pathogenesis of immunologically mediated diseases. Consists of lectures and tutorials in which clinical cases are discussed with faculty tutors. Details of each case covering a number of immunological issues in the context of disease are posted on a student website. Sections are integrated with HST.031. Only HST students may register under HST.175, graded P/D/F. Enrollment limited to 45 students.
S. Pillai, Staff

HST.186–HST.187 Special Subjects in Health Sciences and Technology
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

HST.188–HST.189 Special Subjects in Health Sciences and Technology
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Opportunity for group study of advanced subjects related to health sciences and technology not otherwise included in the curriculum. Offerings are initiated by HST faculty on an ad hoc basis subject to program approval. Prerequisites may vary by topic; consult faculty at time of offering.
J. E. Greenberg

HST.191 Introduction to Biostatistics and Epidemiology
(Subject meets with HST.190)
Prereq: 18.02
G (IAP)
3-0-3 H-LEVEL Grad Credit

Fundamentals of biostatistics and epidemiology. Trains students how to comprehend, critique and communicate findings from biomedical literature. How to assess the importance of chance in the interpretation of experimental data. Topics include probability theory, normal sampling, chi-squared and t-tests, analysis of variance, linear regression and survival analysis, as well as how to perform elementary calculations using the statistical package STATA. How to identify and prevent bias in observational studies. Causal inference, types of bias (confounding, selection and information bias), key study designs (randomized trials, cohort and case-control studies, and screening programs). Only HST students may register under HST.190, graded P/D/F. Enrollment limited, restricted to medical and graduate students.
R. Betensky, M. Hernan

HST.196 Teaching Health Sciences and Technology
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

For teaching assistants in HST where the teaching assignment is approved for academic credit by the department.
J. V. Bonventre, M. L. Gray

HST.198 Special Topics in Health Sciences and Technology
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Opportunity for study of topics related to HST but not included elsewhere in the catalog. Registration under this subject normally used for situations involving individual study under supervision of a faculty member, but may, when appropriate, be used for small study groups.
Normal registration is for 12 units.
J. V. Bonventre

HST.199 Research in Health Sciences and Technology
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

For research assistants in HST where the assigned research is approved for academic credit by the department. Hours are arranged with research supervisor.

HST.200 Introduction to Clinical Medicine
Prereq: Permission of instructor
G (Spring)
9-25-12 [P/D/F] H-LEVEL Grad Credit

February through May, Monday, Wednesday, Friday. Students learn the basic skills involved in examination of the patient and are introduced to history taking and patient interview. Students exposed to clinical problems in medicine, surgery, and pediatrics in groups of two or three students under one faculty member. Findings reported through history taking and oral presentation of the cases to the class. An intensive subject serving as prerequisite to clinical clerkships. Restricted to MD program students.
W. H. Churchill, E. Whang, J. Kosowsky
HST.201 Introduction to Clinical Medicine and Medical Engineering I
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
0-20-0 [P/D/F] H-LEVEL Grad Credit

Develop skills in patient interviewing and physical examination; become proficient at organizing and communicating clinical information in both written and oral forms; begin integrating history, physical, and laboratory data with pathophysiological principles; and become familiar with the clinical decision-making process and broad economic, ethical, and sociological issues involved in patient care. There are two sections: one at Mount Auburn Hospital during IAP, and one at West Roxbury VA Hospital beginning in summer. Restricted to MEMP students.
R. G. Mark, V. Pronio-Stelluto, J. Strymish

HST.202 Introduction to Clinical Medicine and Medical Engineering II
Prereq: HST.201
G (Fall, IAP, Spring, Summer)
0-20-0 [P/D/F] H-LEVEL Grad Credit

Strengthens the skills developed in HST.201 through a six-week clerkship in medicine at a Harvard-affiliated teaching hospital. Students serve as full-time members of a ward team and participate in longitudinal patient care. In addition, students participate in regularly scheduled teaching conferences focused on principles of patient management. Restricted to MEMP students.
V. Pronio-Stelluto, R. G. Mark, J. Strymish

HST.203 Clinical Experience in Medical Engineering and Medical Physics
Prereq: HST.201, HST.202
G (Fall, IAP, Spring, Summer)
0-12-0 [P/D/F] H-LEVEL Grad Credit

An individually arranged full-time one-month directed study in a clinical environment where active medical engineering/medical physics investigation is in progress. Students engage in patient care, particularly those aspects that interface closely with technology. Students also focus on in-depth exploration of the technical and research area. Term paper required.
E. N. Brown

HST.204 Industrial Experience in Medical Engineering and Medical Physics
Prereq: HST.595
G (Fall, IAP, Spring, Summer)
0-12-0 [P/D/F] H-LEVEL Grad Credit

An individually arranged full-time eight week (or longer) internship in an industrial environment in the field of medical engineering/medical physics. Students participate in a clinically related research and/or development project. Students required to attend a series of industry-related seminars during the term before the internship. A term paper and final presentation are required. May not be repeated for credit.
J. Weaver

HST.205 Enterprise Experience in Medical Engineering & Medical Physics
Prereq: HST.572
G (Fall, IAP, Spring, Summer)
0-12-0 [P/D/F]

An individually arranged full-time one-month directed study in a commercial environment where active medical engineering/medical physics commercialization is in progress. Students are actively engaged in biomedical enterprise, particularly the due diligence process that critically examines the medical need, market size, patient and/or physician technology foundation, intellectual property, reimbursement issue and competition from existing and pending biomedical technologies. Term paper required.
J. C. Weaver

HST.211 Biomedical Enterprise Clinical Experience I
Prereq: Permission of instructor
G (IAP)
3-0-3 H-LEVEL Grad Credit

Provides students with an understanding of the strategy, rules, design and conduct of human studies and clinical trials. Explore how, when and why medical practice and biomedical enterprise intersect. Interact with academic physicians engaged in development of technology, perform clinical autopsies on failed biomedical enterprises, and develop the knowledge base needed for elective clinical experiences. Restricted to HST BEP students.
R. Anderson

HST.212 Biomedical Enterprise Clinical Experience II
Prereq: HST.211
G (Spring)
3-0-3 H-LEVEL Grad Credit

Provides an opportunity for students to build on the knowledge and skills developed in HST.211, as well as explore clinical aspects relevant to their respective thesis projects. Restricted to HST BEP students.
R. Anderson

HST.220 Introduction to the Care of Patients
Prereq: Permission of instructor
G (Fall, Spring)
2-0-2 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Elective subject for HST/MD candidates only. Year-long subject: students must register for both Fall and Spring terms. Provides an introduction to the care of patients through opportunities to observe and participate in doctor-patient interaction in an outpatient, office-based environment and through patient-oriented seminars. Students are exposed to some of the practical realities of providing patient care. Topics include basic interviewing, issues of ethics and confidentiality, and other aspects of the doctor-patient relationship. Requirements include regular attendance, and a short paper on patient care. Enrollment limited to 15.
W. M. Kettlely, MIT Medical Department Staff

HST.240 Translational Medicine Preceptorship (New)
Prereq: 7.01, HST.035
G (Fall, Spring)
0-12-0 H-LEVEL Grad Credit

Individually designed preceptorship joins together scientific research and clinical medicine. Students devote approximately half of their time to clinical experiences, and the remaining part to scholarly work in basic or clinical science. The two might run concomitantly or in series. Follow a clinical preceptor’s daily activity, including aspects of patient care, attending rounds, conferences, and seminars. Research involves formal investigation of a focused and directed issue related to selected clinical area. Final paper required. Enrollment limited to students in the GEMS Program.
E. R. Edelman, R. R. Anderson, V. Sukhatme

HST.391 Principles of Clinical Investigation Seminar
Prereq: Permission of instructor
G (Fall, IAP, Spring)
3-0-3 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit

Weekly seminar and case discussion series covering the essential elements of biomedical ethics, study design, statistics, pharmacoconomics, and other subjects germane to clinical research. Enrollment limited.
R. Rubin, A. Hollenberg
HST.410] Projects in Microscale Engineering for the Life Sciences
(Same subject as 6.07J)
Prereq: —
U (Spring)
2-4-3

A project-based introduction to manipulating and characterizing cells and biological molecules using microfabricated tools. In the first half of the term, students perform laboratory exercises designed to introduce the design, manufacture, and use of microfluidic channels; techniques for sorting and manipulating cells and biomolecules; and making quantitative measurements using optical detection and fluorescent labeling. In the second half of the term, students work in small groups to design and test a microfluidic device to solve a real-world problem of their choosing. Includes exercises in written and oral communication and teamwork. Enrollment limited to 20 students. Preference to freshmen.

D. Freeman, M. Gray, A. Aranyosi

HST.422] A Clinical Approach to the Human Brain
(Same subject as 9.22J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9

See description under subject 9.22J.
T. N. Byrne

HST.424] Diseases of the Nervous System
(Same subject as 9.24J)
Prereq: 9.01
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9

See description under subject 9.24J.
T. N. Byrne

HST.450] Biological Physics
(Same subject as 8.593J)
Prereq: 8.044 recommended but not necessary
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit

See description under subject 8.593J.
G. Benedek

HST.452] Statistical Physics in Biology
(Same subject as 8.592J)
Prereq: 8.333 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

See description under subject 8.592J.
M. Kardar, L. Mirny

HST.460] Statistics for Neuroscience Research
(Same subject as 9.073J)
Prereq: 9.07 or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9

See description under subject 9.073J.
E. N. Brown

HST.481–HST.489 Special Subjects in Health Sciences and Technology
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Group study of subjects related to health sciences and technology not otherwise included in the curriculum. Prerequisites may vary by topic; consult faculty at time of offering.

J. E. Greenberg

HST.491 Reviewing Biomedical Literature
Prereq: —
U (Spring)
1-0-2
Can be repeated for credit

Assessing the value and validity of select journal articles from biomedical literature. Detailed student presentations in a standard or journal review format. Enrollment limited to 15.

D. S. Kohane

HST.500 Frontiers in (Bio)Medical Engineering and Physics
Prereq: —
G (Spring)
3-0-9

Provides a framework for mapping research topics at the intersection of medicine and engineering/physics in the Harvard-MIT community and covers the different research areas in MEMP (for example, regenerative biomedical technologies, biomedical imaging and biooptics). Lectures provide fundamental concepts and consider what’s hot, and why, in each area. Writing workshops help students answer the following questions: “How can I identify and structure a research project that is novel?”, “How do I position my re-search within the scientific community?”, “How do I present preliminary data effectively?” and “How do I give and respond to peer reviews?”

S. Bhatia, M. Poe

HST.505 Laboratory in Molecular and Cellular Sciences
Prereq: Biochemistry or cell biology
G (IAP)
3-4-5 H-LEVEL Grad Credit

Provides laboratory training in state-of-the-art experimental approaches and techniques in molecular and cellular sciences. Lab training is reinforced with didactic lectures which stress the theory behind these methodologies. Topics include mammalian cell culture; tissue engineering; DNA cloning; gene transfer and gene therapy; transgenic animals; protein purification and analysis; and microscopy. Emphasis on the quantitative aspects of these methodologies. Students learn how to incorporate these approaches into an interdisciplinary research strategy aimed at addressing important questions in biomedical research.

J. Shah, J. Morgan, F Berthiaume, Z. Megeed

HST.508 Quantitative Genomics
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Provides a foundation in the following four areas: evolutionary and population genetics; comparative genomics; structural genomics and proteomics; and functional genomics and regulation. Each module consists of four lectures providing key background material, one lecture providing clinical correlates and one guest lecture from leaders in the field.

L. Mirny, I. Kohane, S. Sunyaev

HST.509 Computational and Functional Genomics
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit

Experimental functional genomics, computational prediction of gene function, and properties and models of complex biological systems. Primarily critical reading and discussion. Molecular biology, solid understanding of basic probability and statistics recommended. Follows Harvard FAS calendar.

M. L. Bulyk, F. P. Roth, S. R. Sunyaev
HST.510 Genomics, Computing, Economics, and Society
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Aspects of modern technology displaying exponential growth curves and the impact on global quality of life learned through a class project integrating knowledge and providing practical tools for political and business decision-making concerning new aspects of bioengineering, personalized medicine, genetically modified organisms, and stem cells. Interplays of economic, ethical, ecological, and biophysical modeling explored through multidisciplinary teams of students, and individual brief reports. Follows Harvard FAS calendar.
G. Church

HST.512 Genomic Medicine
(Subject meets with HST.513)
Prereq: HST.160 or basic genetics and molecular biology
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 [P/D/F] H-LEVEL Grad Credit
Studies the use of industrialized methods of data acquisition and analysis to improve medical care. Questions addressed are: what new benefits of genomics can be anticipated in the near future in terms of new drugs and treatments? How can diagnosis and the diagnostic process be changed today? How do our prognostic abilities change? How does one manage the deluge of clinically relevant genomic data? What constitutes a genomic clinical trial? What are the useful features of alternative genomic technologies today and for the near future? What are the different kinds of genomic informational resources and databases? Are they useful and how? What are the ethical individual and corporate challenges ahead? What are the key limitations we face? Enrollment limited.

HST.513 Genomic Medicine
(Subject meets with HST.512)
Prereq: HST.160 or basic genetics and molecular biology
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject HST.512. Enrollment limited.
I. Kohane, Staff

HST.514J Sensory-Neural Systems: Spatial Orientation from End Organs to Behavior and Adaptation
(Same subject as 16.430J)
Prereq: Neuroscience or systems engineering or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Introduces sensory systems, and multi-sensory fusion using the vestibular and spatial orientation systems as a model. Topics range from end organ dynamics to neural responses, to sensory integration, to behavior, and adaptation, with particular application to balance, posture and locomotion under normal gravity and space conditions. Depending upon the background and interests of the students, advanced term project topics might include motion sickness, astronaut adaptation, artificial gravity, lunar surface locomotion, vestibulo-cardiovascular responses, vestibular neural prostheses, or other topics of interest.
L. Young, C. Oman, D. Merfeld, R. Lewis, C. Wall, L. Zupan

HST.515J Aerospace Biomedical and Life Support Engineering
(Same subject as 16.423J, ESD.65J)
Prereq: 16.400, 16.06, 16.060, or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-1-8 H-LEVEL Grad Credit
See description under subject 16.423J.
D. J. Newman

HST.516 Circadian Biology: From Cellular Oscillations to Sleep Regulation
Prereq: Biological sciences
G (Fall)
4-0-8 H-LEVEL Grad Credit
Properties, mechanisms, and functional roles of circadian rhythms in organisms ranging from unicells to mammals. Cellular and molecular components, regulation of gene expression and physiological functions, genetic and biochemical analyses of circadian rhythms, and neurobiology of the mammalian circadian pacemaker. Mathematics and modeling of oscillatory systems and applications to circadian rhythms. Experimental studies of human rhythms, including the sleep-wake cycle and hormone rhythms, with applications to sleep disorders. Follows Harvard FAS calendar.
J. W. Hastings, C. A. Czeisler, J. Gooley

HST.521 Biomaterials and Tissue Engineering in Medical Devices and Artificial Organs
Prereq: HST.030/HST.031 or permission of instructor
G (Spring)
4-0-5 H-LEVEL Grad Credit
Biomaterials science (science and technology of synthetic or modified natural materials used to replace or augment tissues, organs or biological functions) and tissue engineering (tissue grafts engineered in vitro or in vivo by using cells, biomaterials and biological signals, and part of the larger field of regenerative medicine) are key areas of biomedical engineering. Covers the structure, properties and therapeutic applications of biomaterials, as well as the opportunities and scientific and technological challenges of tissue engineering. Provides an integrated and highly multidisciplinary biological-engineering approach in a mixed academic/corporate context and probes mechanisms and methods of evaluation of tissue/biomaterials and patient/device interactions. Assesses current outcomes, current challenges and cutting edge technological solutions to medical problems. Additional topics include key biological concepts; biofunctional/bioactive materials, drug delivery, and pertinent advances in nanotechnology; technical issues in design, development, fabrication and clinical evaluation; novel research directions and applications of materials to medicine; and ethical, economic and regulatory considerations.
F. J. Schoen, A. Khademhosseini

HST.522J Biomaterials: Tissue Interactions
(Same subject as 2.79J, 3.97J, 20.441J)
Prereq: 3.091; 5.111 or 5.112; 2.005 or 5.60; 7.012, 7.013, 7.014, or 7.015
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.441J.
I. V. Yannas, M. Spector

HST.523J Cell-Matrix Mechanics
(Same subject as 2.785J, 3.97J, 20.441J)
Prereq: 3.091, 5.11, 5.111, or 5.112; 2.005 or 5.60; 7.012, 7.013, 7.014, or 7.015
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.785J.
I. V. Yannas, M. Spector
HST.524J Design of Medical Devices and Implants
(Same subject as 2.782J, 3.961J, 20.451J)
Prereq: 2.79J or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.782J.
I. V. Yannas, M. Spector

HST.525J Tumor Pathophysiology and Transport Phenomena: A Systems Biology Approach
(Same subject as 10.548J)
Prereq: 18.03; 10.301
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
2-0-4 H-LEVEL Grad Credit

Tumor pathophysiology plays a central role in the growth, invasion, metastasis and treatment of solid tumors. Principles of transport phenomena are applied to develop a systems level, quantitative understanding of angiogenesis, blood flow and microcirculation, metabolism and microenvironment, transport and binding of small and large molecules, movement of cancer and immune cells, metastatic process, and treatment response.
R. K. Jain

HST.527 Blood Vessels and Endothelial Phenotypes in Health and Disease
Prereq: Intro biology and/or physiology, biochemistry or molecular biology or permission of instructor
G (Spring)
2-0-4 [P/D/F] H-LEVEL Grad Credit

Overview of the endothelium as a model system for understanding biological complexity in health and disease. Emphasis placed on: mechanisms of endothelial cell heterogeneity, including genetic and microenvironmental determinants; the role of endothelial cell trafficking, hemostasis, barrier function, antigen presentation and vasomotor tone; and the role of endothelial cell dysfunction in disease, including tumors, sickle cell disease, pulmonary hypertension, veno-occlusive disease of the liver, thrombotic microangiopathies and xenotransplantation. Additional topics covered include novel proteomic and genomic strategies for mapping endothelial cell phenotypes, evolutionary (Darwinian) principles, and complexity theory.
W. Aird, G. Garcia-Cardena

HST.532J Hyperthermia and Clinical Applications of Bioheat Transfer (New)
Prereq: —
G (Spring)
3-0-9

H. F. Bowman

HST.535 Principles and Practice of Tissue Engineering
Prereq: —
G (Fall)
2-0-6

Using televised sessions, faculty of HST/MIT-Harvard and Tsinghua University in Beijing, China teach the principles and practice of tissue engineering (and regenerative medicine) to students of both institutions simultaneously. Topics include the principles underlying strategies for employing selected exogenous cells, biomaterial scaffolds, soluble regulators or their genes, and mechanical loading for the regeneration of tissues and organs in vitro and in vivo. Differentiated cell types and stem cells are compared and contrasted for this application, as are natural and synthetic scaffolds. The rationale for employing selected growth factors is covered and the methods for incorporating their genes into the scaffolds are examined. Discussion addresses the influence of environmental factors including mechanical loading and culture conditions. Methods for fabricating tissue-engineered products and devices for implantation are taught. Examples of procedures currently employed clinically are analyzed as case studies.
M. Specter, F. Z. Cui

HST.540J Human Physiology
(Same subject as 7.20J)
Prereq: 7.05
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
5-0-7
See description under subject 7.20J.
M. Krieger, D. Sabatini

HST.541J Quantitative Physiology: Cells and Tissues
(Same subject as 2.794J, 6.521J, 20.470J)
(Subject meets with 2.791J, 6.021J, 20.370J)
Prereq: 2.003, 6.002, 6.071, or 10.301; 8.02, 18.03
G (Fall)
5-2-5

Meets with 6.021J. Requires the completion of more advanced home problems and/or an additional project.
D. M. Freeman, J. Han

HST.542J Quantitative Physiology: Organ Transport Systems
(Same subject as 2.792J, 6.022J, 20.371J)
(Subject meets with 2.796J, 6.522J, 20.471J)
Prereq: 18.03, 8.02, or permission of instructor
U (Spring)
4-2-6
See description under subject 6.022J.
R. G. Mark, C. M. Stultz

HST.543 Cardiac Biophysics
Prereq: 18.03, 6.002, 6.013, and 6.021
G (Fall)
3-0-9 H-LEVEL Grad Credit

A quantitative exploration of cardiac impulse propagation and conduction abnormalities. Membrane ion channels, the cardiac action potential, biophysical principles of propagation, propagation in cellular networks, mechanisms of slow conduction and conduction block, and arrhythmias. Relevant clinical trials data are reviewed as well as structure-function relationships in the cardiac tissue microenvironment. MATLAB programming experience required. C programming experience highly recommended. Follows Harvard FAS schedule.
K. K. Parker

HST.544J Fields, Forces, and Flows in Biological Systems
(Same subject as 2.795J, 6.561J, 10.539J, 20.430J)
Prereq: 6.013, 2.005, 10.302, or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.430J.
A. J. Grodzinsky, R. D. Kamm
HST.545 Introduction to Systems Analysis with Physiological Applications
Prereq: 8.02, 18.03
G (Fall)
3-3-6
A survey of systems theory with applications from bioengineering and physiology. Analysis: modeling real systems as discrete elements; nonlinear systems; the complementary nature of time and frequency methods; feedback; stability; biological oscillations. Applications: muscle dynamics and nerve function; cardiovascular regulation. Laboratory: use of computer models including neural models; feedback control systems; properties of frog muscle; cardiovascular function. Term paper required. Follows Harvard FAS calendar.
G. Stanley

HST.546 Orthopedic Biomechanics
Prereq: 2.002 and 18.03
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit
Introduction to biomechanics as applied to orthopedic science. Review of anatomy, kinematics, and solid mechanics for the musculoskeletal system. Emphasis on the mechanics of joints (movement, force, transmission), bone, soft tissues (cartilage, ligament, muscle), and cellular mechanics and tissue engineering. Special topics include clinical orthopedics, fracture mechanics of bone tissue, Finite Element Analysis of orthopedic implants and the use of MRI and high resolution CT for imaging of musculoskeletal tissues. Follows Harvard FAS calendar.
R. Alkalay

HST.547 Human Pathophysiology (New)
Prereq: HST.031 or HST.035
G (Fall)
3-3-6 H-LEVEL Grad Credit
Covers fundamental physiological principles of human biology and selected mechanisms of disease. Emphasis on integration of basic science underlying a pathological condition with the clinical manifestations. Introduction to specific drugs that are relevant to a disease and examples of where cutting-edge research has impacted on pathophysiology, diagnosis and/or management. The first sessions devoted to basic physiologic principles and organ/organism homeostasis, including membrane transport, control of cell volume, fluid, electrolyte and acid-base balance, hormones, signal transduction, endothelial biology, autonomic transmission, and skeletal and smooth muscle physiology.
The second half covers endocrinology (including diabetes), pulmonary disorders, cardiology and hematology. Follows Harvard’s academic calendar. Open to GEMS and BEP students; others by permission of instructor. Limited to 30 students (including HMS and MIT).
J. Seifter, F. Bunn

HST.548 Neural Signal Processing
Prereq: 8.02, 18.03
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-3-6
Examines the generation, transmission, and processing of signals in single nerve cells and in neural networks, with emphasis on physical principles and careful mathematical formulation. Develops relevant analytical techniques (network theory, random processes, differential equations). Special attention to relations among morphology, physiology, and psychophysics in mammalian visual systems. Term paper required. Follows Harvard FAS calendar.
G. Stanley

HST.557 Introduction to Molecular Simulations
(Same subject as 6.582J)
Prereq: 6.581J, 7.91J, 18.417J, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 6.582J.
C. M. Stultz

HST.558 Introduction to Modeling and Simulation
Engineering School-Wide Elective Subject.
(Offered under: 1.021, 2.088, 3.021, 10.333, 18.361, 22.00, HST.558)
Prereq: 18.03
U (Spring)
3-0-9 REST
See description under subject 22.00.
M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Radovitzky, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

HST.560J Radiation Biophysics
(Same subject as 22.55J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 22.55J.
J. A. Codere

HST.561J Noninvasive Imaging in Biology and Medicine
(Same subject as 9.173J, 20.483J, 22.56J)
Prereq: 18.03, 8.03, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 22.56J.
A. Jasanoff

HST.563 Imaging Biophysics and Clinical Applications (New)
Prereq: 18.03 and 8.03; or permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
2-1-9 H-LEVEL Grad Credit
Introduction to the connections and distinctions among various imaging modalities (ultrasound, MRI, EEG, optical), common goals of biomedical imaging, broadly defined target of biomedical imaging, and the current practical and economic landscape of biomedical imaging research. Emphasis on applications of imaging research. Final project consists of student groups writing mock grant applications for biomedical imaging research project, modeled after an exploratory NIH grant application.
S. Stufflebeam, D. Boas, F-H. Lin

HST.569 Biomedical Optics
Prereq: Calculus
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit
Introduction to physics and engineering of optical technologies and their applications in medicine and biology. Propagation of light in tissue, bright field, dark field, phase contrast, DIC, fluorescence, Raman, confocal, two-photon, low-coherence, spectral microscopy, and speckle. Current trends in microscopy and optical imaging. Subject is appropriate for upper level undergraduates and graduate students in life sciences as well as engineering. Subject consists of lectures, seminars and occasional guest lectures. Grading based on mid-term and final report. Report analyzes a specific technological need in medicine or biology and proposes a solution. The opportunity to pursue the implementation of the solution as a project in the following term is available.
B. E. Bouma, G. J. Tearney, J. F. de Boer

HST.569J Biomedical Optics
Prereq: Calculus
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit
Introduction to physics and engineering of optical technologies and their applications in medicine and biology. Propagation of light in tissue, bright field, dark field, phase contrast, DIC, fluorescence, Raman, confocal, two-photon, low-coherence, spectral microscopy, and speckle. Current trends in microscopy and optical imaging. Subject is appropriate for upper level undergraduates and graduate students in life sciences as well as engineering. Subject consists of lectures, seminars and occasional guest lectures. Grading based on mid-term and final report. Report analyzes a specific technological need in medicine or biology and proposes a solution. The opportunity to pursue the implementation of the solution as a project in the following term is available.
B. E. Bouma, G. J. Tearney, J. F. de Boer
HST.571 Introduction to Biotechnology  
Prereq: Permission of instructor, understanding of organic chemistry  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
4-0-8  
Introduces students to discovery, pre-clinical, and clinical development in the biomedical industry. Shows students in the applied sciences how biomedical technologies are conceived, funded, developed, and commercialized in the US, with detailed consideration of the US Patent Office and the US FDA. Students work together on semester-long projects aimed to investigate the scientific and commercial potential of publicly-traded biomedical companies. Senior representatives of the companies give invited lectures. Other invited lectures are delivered by leading scientists and financial analysts in the biomedical field. Students prepare mid-term and final presentations and written reports on their selected technologies. Students expected to actively participate in class and may occasionally visit local biomedical industries. Follows Harvard FAS calendar.  
D. Edwards

HST.572 Future Medical Technologies  
Prereq: Permission of instructor  
G (Spring)  
2-0-4 [P/D/F]  
Subject helps medical and graduate students to develop an understanding of the limitations of current medical technology and the process of creating and transferring new medical technology from research into actual use (commercialization). Topics include pharmaceuticals, drug delivery, and medical devices. In a seminar setting, students interact with biomedical scientists, engineers, and entrepreneurs directly involved in creating new companies based on future technologies. Students may find this subject helpful in evaluating possible theses. Open to advanced undergraduates with permission of instructor.  
J. C. Weaver

HST.573 Complex Biological Control Systems  
Prereq: 6.003 or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
3-0-9 H-LEVEL Grad Credit  
Application of control theory to the modeling and analysis of biological systems. Dynamics and system identification of linear and nonlinear models. Feedback, feedforward, adaptive, and optimal and fuzzy control mechanisms in physiological control. Oscillation, chaos, criticality and catastrophe phenomena in nonlinear biological systems. Complexity of biological structures and functions. Emphasis on mathematical analysis and computer simulation with examples from a wide variety of biological and clinical applications.  
C. -S. Poon

HST.574 Introduction to Sensorimotor Neuroengineering  
Prereq: 6.003, 2.003, or permission of instructor; 9.01, 9.011, or HST.130/HST.131 recommended but not required  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Introduces an integrated approach to understanding normal and pathological human movement control in terms of its neurophysiology, neurology, and biomechanics from the perspective of basic linear control theory. Issues include postural stability, tracking performance, effects of signal transmission delays, feedback versus feedforward control, “internal models”, continuous versus segmented control, and their degradation in the context of clinical motor control disorders. Lectures and classroom discussions are based on a motor neurophysiology text and assigned review of current and historical literature on experiments and system modeling. Problem sets emphasize MATLAB modeling and simulation. Provides a foundation for students with either biological or engineering backgrounds seeking to analyze sensorimotor control in health and disease, and/or to design prosthetic, orthotic or biomorphic robotic systems. A final project/presentation is required.  
S. Massaquoi

HST.575j Bioelectronics Project Laboratory  
(Same subject as 6.121j)  
Prereq: 6.002 or 6.071  
U (Spring)  
2-8-2 Institute LAB  
See description under subject 6.121j.  
R. Sarapeshkar, D. M. Freeman, S. K. Burns

HST.576j Topics in Neural Signal Processing  
(Same subject as 9.272j)  
Prereq: —  
Acad Year 2007–2008: G (Spring)  
Acad Year 2008–2009: Not offered  
3-0-9  
See description under subject 9.272j.  
E. N. Brown

HST.580j Data Acquisition and Image Reconstruction in MRI  
( Same subject as 6.556j)  
Prereq: 6.011  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
See description under subject 6.556j.  
E. Adalsteinsson

HST.582j Biomedical Signal and Image Processing  
( Same subject as 6.555j, 16.456j)  
Prereq: 6.003, 2.004, 16.004, or 18.085  
G (Spring)  
3-6-3 H-LEVEL Grad Credit  
Fundamentals of digital signal processing with particular emphasis on problems in biomedical research and clinical medicine. Basic principles and algorithms for data acquisition, imaging, filtering, and feature extraction. Laboratory projects provide practical experience in processing physiological data, with examples from cardiology, speech processing, and medical imaging. 6 Engineering Design Points.  

HST.583 Functional Magnetic Resonance Imaging: Data Acquisition and Analysis  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
Units arranged H-LEVEL Grad Credit  
Provides information relevant to the conduct and interpretation of human brain mapping studies. In-depth coverage of the physics of image formation, mechanisms of image contrast, and the physiological basis for image signals. Parenchymal and cerebrovascular neuroanatomy and application of sophisticated structural analysis algorithms for segmentation and registration of functional data discussed. Additional topics include fmri experimental design including block design, event related and exploratory data analysis methods, and building and applying statistical models for fmri data. Human subject issues including informed consent, institutional review board requirements and safety in the high field environment are presented. Twice
weekly lectures and weekly laboratory and discussion sessions. Laboratory will include fMRI data acquisition sessions and data analysis workshops. Assignments include reading of both textbook chapters and primary literature as well as fMRI data analysis in the laboratory. Probability, linear algebra, differential equations, and introductory or college-level subjects in neuroscience, physiology, and physics required.


HSt.584] Magnetic Resonance Analytic, Biochemical, and Imaging Techniques
(Same subject as 22.561)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-12 H-LEVEL Grad Credit

Introduction to basic NMR theory. Examples of biochemical data obtained using NMR summarized along with other related experiments. Detailed study of NMR imaging techniques includes discussions of basic cross-sectional image reconstruction, image contrast, flow and real-time imaging, and hardware design considerations. Exposure to laboratory NMR spectroscopic and imaging equipment included.

B. R. Rosen

HSt.585] Biosensors, Signal Processing, and Biomedical Applications
(Same subject as 6.566)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit

Principles of measurements and instrumentation, emphasizing quantitative modeling of basic transduction (sensing) processes, interaction of sensors with biological systems (e.g. human body, clinical specimens), and both fundamental and practical limitations on the signal-to-noise ratio. Emphasis on modern signal processing strategies involving intensive real-time computation as an integral part of the measurement process. Some background in life sciences and electronics assumed.

J. C. Weaver, S. K. Burns

HSt.586–589 Special Subjects in Medical Engineering and Medical Physics
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Opportunity for group study of advanced subjects related to the Medical Engineering and Medical Physics Program not otherwise included in the curriculum. Offerings are initiated by MEMP faculty on an ad hoc basis subject to program approval. Prerequisites may vary by topic; consult faculty at time of offering.

J. Greenberg

HSt.594 Translational Medicine Seminars (New)
Prereq: —
G (Fall, Spring)
1-0-0 [P/D/F]
Can be repeated for credit

Speakers involved in the translation of basic medically relevant modern biology (molecular genetics, cell biology, genomics, proteomics) into applications for the diagnosis or treatment of disease discuss the process, successes and challenges. Examples from different areas of medicine illustrate topics covered: what is translational research; why it is often conducted as a bidirectional process; the difficulties in extrapolating preclinical data to humans; issues related to patient enrollment, compliance and rights; study design and protocol management; funding; availability of suitable grade therapeutic reagents. The multidisciplinary nature of the enterprise are highlighted, including the management of industry and academic center relationships. Preference to GEMS, then HMS Leder and MIT. Enrollment limited to 25.

V. P. Sukhatme

HSt.598 Special Topics in Health Sciences and Technology
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

For undergraduates desiring to carry on substantial projects of their own choosing in biomedical sciences or engineering. Work may be of experimental, theoretical, or design nature. A project proposal is required at time of registration.

Consult J. Greenberg

HSt.599 Special Topics in Health Sciences and Technology
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Assigned reading or research on special topics in theoretical, experimental, or clinical aspects of biomedical sciences or engineering. Arranged on individual basis with instructor. A project proposal is required at time of registration. Approval of coordinator required.

Consult J. Greenberg
HST.710 | Speech Communication
(Same subject as 6.541, 24.968j)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject 6.541j.
K. N. Stevens, S. Shattuck-Hufnagel

HST.712 | Laboratory on the Physiology,
Acoustics, and Perception of Speech
(Same subject as 6.542, 24.966j)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
2-2-8 H-LEVEL Grad Credit
See description under subject 6.542j.
K. N. Stevens, J. S. Perkell, S. Shattuck-Hufnagel

HST.714 | Acoustics of Speech and Hearing
(Same subject as 6.551j)
Prereq: 8.03 and 6.003; or permission of instructor
G (Fall)
4-1-7 H-LEVEL Grad Credit
See description under subject 6.551j.
L. D. Braida, J. J. Rosowski, C. Shera,
K. N. Stevens

HST.716 | Signal Processing by the Auditory System:
Perception
(Same subject as 6.552j)
Prereq: 6.003; 6.041 or 6.431; or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 6.552j.
L. D. Braida

HST.718 | Anatomy of Speech and Hearing
Prereq: 7.012, 7.013, or 7.014; permission of instructor
G (IAP)
2-2-2 H-LEVEL Grad Credit
Study of the human body and brain, focusing on structures of the head and neck involved in speech and hearing. General organization of the nervous system and control of the peripheral structures. Involves dissection of a human cadaver and examination of brain specimens. Preference to students with some biology background and order of seniority of class.
B. C. Fullerton

HST.720 | Physiology of the Ear
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
4-0-8 H-LEVEL Grad Credit
Physical and physiological mechanisms underlying the transduction and analysis of acoustic signals in the auditory periphery. Topics include the acoustics, mechanics, and hydromechanics of sound transmission; the biophysical basis for cochlear amplification; the production of otoacoustic emissions; the physiology of hair-cell transduction and synaptic transmission; efferent feedback control; the analysis and coding of simple and complex sounds by the inner ear; and the physiological bases for hearing disorders. Based primarily on reading and discussions of original research literature.
J. J. Guinan, J. J. Rosowski, C. A. Shera

HST.721 | The Peripheral Auditory System
Prereq: Permission of instructor
G (Fall)
3-1-8 H-LEVEL Grad Credit
Experimental approaches to the study of hearing and deafness, presented through lectures, laboratory exercises and discussions of the primary literature on the auditory periphery. Topics include inner ear development; functional anatomy of the inner ear; cochlear mechanics and micromechanics; mechno-electric transduction by hair cells; outer hair cells’ electromotility and the cochlear amplifier; otoacoustic emissions, synaptic transmission; stimulus coding in auditory nerve responses; efferent control of cochlear function; damage and repair of hair-cell organs; and sensorineural hearing loss.
M. C. Liberman, J. C. Adams, R. A. Eatock

HST.722 | Brain Mechanisms for Hearing and Speech
(Same subject as 9.044j)
Prereq: HST.723 or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
4-0-8 H-LEVEL Grad Credit
An advanced subject covering anatomical, physiological, behavioral, and computational studies of the central nervous system relevant to speech and hearing. Students learn primarily by discussions of scientific papers on topics of current interest. Recent topics include neural circuits in the auditory brainstem, organization and processing in the auditory cortex, auditory reflexes and descending systems, functional imaging of the human auditory system, quantitative methods for relating neural responses to behavior, speech motor control, and cortical representation of language.
M. C. Brown, B. Delgutte, F. Guenther, J. Melcher

HST.723 | Neural Coding and Perception of Sound
(Same subject as 9.285j)
Prereq: Permission of instructor
G (Spring)
3-1-8 H-LEVEL Grad Credit
Neural structures and mechanisms mediating the detection, localization, and recognition of sounds. Discussion of how acoustic signals are coded by auditory neurons, the impact of these codes on behavioral performance, and the circuitry and cellular mechanisms underlying signal transformations. Topics include temporal coding, neural maps and feature detectors, learning and plasticity, and feedback control. General principles are conveyed by theme discussions of auditory masking, sound localization, musical pitch, cochlear implants, and auditory scene analysis.
B. Delgutte, M. C. Brown, J. J. Guinan, J. Melcher

HST.724 | Clinical Aspects of Speech and Hearing
Prereq: HST.714j, HST.718, and HST.721
G (Spring)
5-5-2 H-LEVEL Grad Credit
Clinical approach to speech and hearing disorders as practiced by physicians, audiologists, speech clinicians, rehabilitation specialists, pathologists, and bioengineers. Includes observation of patient care in the clinic and operating room; laboratory experience in audiology, voice and speech evaluation, evaluation of balance disorders; lectures and discussion groups.
J. B. Nadol, Staff

HST.725 | Music Perception and Cognition
Prereq: HST.723 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
4-0-8 H-LEVEL Grad Credit
Survey of perceptual and cognitive aspects of the psychology of music, with special emphasis on underlying neuronal and neurocomputational representations and mechanisms. Basic perceptual dimensions of hearing, salient qualities, contrasts, patterns and streams that are used in music to convey melody, harmony, rhythm, and separate voices. Perceptual, cognitive, and neurophysiological concomitants of the temporal dimension of music are explored. Special topics include comparative, evolutionary, and developmental psychology of music perception, biological vs. cultural influences, Gestaltist vs. associationist vs. schema-based theories, comparison of music and speech perception, paral-
levels between music cognition and language, music and cortical function, and the neural basis of music performance.

P. Cariani

HST.727| The Lexicon and Its Features
(Same subject as 6.543J, 9.587J, 24.941J)
Prereq: 24.901 or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 24.941J.
D. Gow, D. Steriade, K. N. Stevens, S. Shattuck-Hufnagel

HST.728| Automatic Speech Recognition
(Same subject as 6.345J)
Prereq: 6.003, 6.041
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-1-8 H-LEVEL Grad Credit
See description under subject 6.345J.
V. W. Zue, J. R. Glass

HST.729 Advanced Speech and Audio Processing
Prereq: 6.003
G (Spring)
3-0-9 H-LEVEL Grad Credit
Introduction to advanced speech and audio processing, including both mathematical models and practical applications thereof. Time-frequency analysis, synthesis, modification, and coding of information-carrying natural sound signals; relevant aspects of acoustics and auditory perception; fundamental contemporary applications and methodologies. Students are required to prepare a substantial term project at a level on par with current research in the field. Subject follows Harvard FAS schedule.
P. J. Wolfe

HST.730 Molecular Biology of the Auditory System
Prereq: 7.012, 7.013, 7.014, or 7.015
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Advanced subject in the molecular biology of the auditory system. Focuses on molecular approaches to function and dysfunction of the cochlea, based on readings and discussion of research literature. Lectures are delivered by course directors and local experts in the field. Laboratory component includes molecular biology techniques with emphasis on auditory gene identification.
A. B. S. Giersch, A. Edge

HST.750 Modeling Issues in Hearing and Speech
Prereq: HST.714|/6.551J and HST.721
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Explores the theory and practice of scientific modeling in the context of auditory and speech biophysics. Based on seminar-style discussions of the research literature, subject draws on examples from hearing and speech (cochlear and vocal-fold mechanics) and explores general, meta-theoretical issues that transcend the particular subject matter. Examples include: What is a model? What is the process of model building? What are the different approaches to modeling? What is the relationship between theory and experiment? How are models tested? What constitutes a good model?
C. A. Shera, J. R. Melcher

HST.771–HST.779 Research in the Speech and Hearing Sciences
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Research on topics in theoretical, experimental, or clinical aspects of Speech and Hearing Sciences arranged on an individual basis with a research supervisor. At the time of registration, a project proposal endorsed by the supervisor is required. At the end of the term, a concise written progress report along with a brief written evaluation by the supervisor must be submitted.
L. D. Braida

HST.780–789 Special Subjects in the Speech and Hearing Sciences
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for group study of advanced subjects related to the Speech and Hearing Sciences not otherwise included in the curriculum. Offerings initiated by members of the SHBT faculty on an ad hoc basis subject to program approval. Prerequisites may vary by topic; consult faculty at time of offering.
L. D. Braida

HST.790 Research Approaches to Speech and Hearing
Prereq: 6.021J or 7.20 or 9.00
G (Spring)
6-0-6 H-LEVEL Grad Credit
Approaches and techniques of speech and hearing research are analyzed through the preparation of a mock thesis proposal. Professional responsibilities of scientists and issues such as standards for conducting research, integrity in science, and criteria for human and animal studies examined in detail. A written mock thesis proposal required.
D. K. Eddington, Staff

HST.791 Speech and Hearing Laboratory Visits
Prereq: —
G (Fall, Spring)
0-1-0 [P/D/F]
Can be repeated for credit
A weekly meeting to acquaint first-year students in the Speech and Hearing Bioscience and Technology Program with research opportunities. Meetings at different laboratories are hosted by faculty members of the program. These informal, introductory visits are designed to acquaint students with the kinds of work done in each laboratory.
L. D. Braida, Staff

HST.901| Health Economics
(Same subject as 14.21J)
Prereq: 14.01
U (Fall)
3-0-9 HASS
See description under subject 14.21J.
J. E. Harris

HST.903| Health Economics Seminar
(Same subject as 14.286J)
Prereq: 14.04, permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
See description under subject 14.286J.
J. E. Harris

HST.905 Introduction to Health Management (New)
Prereq: —
G (Spring)
2-0-4
Introduction to the academic disciplines of business management with illustration from examples in various medical care settings. Topics include economics of health care; evolving role of physicians and other medical professionals; ethics of business decisions in a clinical context; underlying concepts in financial, marketing, and operations management in health institutions; and the management of risk in health-related enterprise. Presentations by carefully selected multidisciplinary faculty group from the Harvard and MIT communities. Student projects address current issues occasioned by the rapidly chang-
ing health care environment. Meets at Harvard Medical School. Enrollment limited to graduate and medical students.
S. Finkelstein, P. L. Slavin

HST.906 Role of Physicians and Scientists in the Business World
Prereq: Permission of instructor
G (Spring)
2-0-0 [P/D/F]
A pragmatic, experience-based subject for MDs and PhDs surveying career opportunities in industry, including case studies of pharmaceutical, medical device and biotech companies. Covers venture capital processes, company formation and capitalization, innovative technology sources, tech transfer process at universities and medical schools, startup operational issues, role of VCs and board members, execution time frames, liquidity process, IPOs, mergers and acquisitions, and payout prospects for founders and inventors. A high tech career-planning guide from over twenty years of entrepreneurship VC practice in medical and biotech companies is shared.
J. M. Gill

HST.916J Case Studies and Strategies in Drug Discovery and Development
(Same subject as 7.549J, 15.137J, 20.486J)
Prereq: Permission of instructor
G (Spring)
2-0-4 H-LEVEL Grad Credit
See description under subject 20.486J.

HST.918J Economics of the Health Care Industries
(Same subject as 15.141J)
Prereq: Permission of instructor
G (Spring)
3-0-6 H-LEVEL Grad Credit
See description under subject 15.141J.
E. R. Berndt

HST.920J Principles and Practice of Drug Development
(Same subject as 7.547J, 10.547J, 15.136J)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
See description under subject 15.136J.
T. J. Allen, C. L. Cooney, S. N. Finkelstein, R. H. Rubin, A. J. Sinsky

HST.922 Information Technology in the Health Care System of the Future
(Subject meets with HST.921)
Prereq: —
G (Spring)
2-0-7
Innovative, trans-faculty subject teaches how information technologies are reshaping and redefining the health care marketplace through improved economies of scale, greater technical efficiencies in the delivery of care to patients, advanced tools for patient education and self-care, network integrated decision support tools for clinicians, and the emergence of e-commerce in health care. Students ordinarily also register for HST.923 or HST.924, the lab component of this subject. Undergraduates require permission of instructor. (Only HST students may register under HST.921, graded P/D/F.)
S. E. Locke, B. P. Bergeron, J. Blander, D. Z. Sands

HST.924 Information Technology in the Health Care System of the Future (Laboratory)
(Subject meets with HST.923)
Prereq: —
G (Spring)
0-3-0
Student tutorial provides an opportunity for interactive discussion covering emerging information technologies (IT) used in healthcare. Practicum: HMS and MIT graduate students in medicine, business, law, education, engineering, computer science, public health, and government collaborate in interdisciplinary teams to design an innovative IT application. Student projects presented during the final class. Students ordinarily also register for HST.921 or HST.922, the lecture component of the subject. Undergraduates require permission of instructor. (Only HST students may register under HST.923, graded P/D/F.)
S. E. Locke, B. P. Bergeron, J. Blander, D. Z. Sands

HST.930J Social Studies of Biosci and Biotech
(Same subject as STS.449J)
Prereq: —
Acad Year 2007–2008: Not offered
G (Fall)
2-0-1 [P/D/F]
Discusses social, ethical and clinical issues associated with the development of new biotechnologies and their integration into clinical practice. Basic scientists, clinicians, bioethicists, and social scientists present on four general topics: changing political economy of biotech research; problems associated with the adaption of new biotechnologies and findings from molecular biology for clinical settings; the ethical issues that emerge from clinical research and clinical use of new technologies; and the broader social ethics associated with investigations of population genetics and social problems. Use of cases and recent literature.
M. M. Fischer, B. J. Good, M. D. Good

HST.932J The Legal Framework of Biomedical Enterprise
(Subject meets with 15.126J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-3
Designed to prepare managers, physicians, and research scientists to exercise good judgment and leadership when confronting key law-sensitivissues arising in the commercialization of new biomedical technologies. After covering some legal fundamentals, students follow a biomedical enterprise through a typical life cycle. Topics include linkages between university-based research centers and proprietary enterprises, establishing a new venture and obtaining early financing, protection of intellectual property, the FDA process, reimbursement and coverage, liability risks, tapping public securities markets, and corporate partnering and private equity. Special attention is given to the legal, ethical and professional standards that bear upon health care.
J. Akula

HST.935 Narrative Ethics: Literary Texts and Moral Issues in Medicine
Prereq: —
G (IAP)
3-0-3 [P/D/F]
This eight-session subject uses literary narratives and poetry to study ethical issues in medicine. Methodology emphasizes the importance of context and contingency in recognizing, evaluating, and resolving moral problems. Discussions focus on developing the skills of critical and reflective reading that increase effectiveness in clinical medicine. Texts include short fiction and poetry by Chekhov, Carver, Kafka, Morrison, Hawthorne, Selzer, Oe, and Williams. Instructor provides necessary philosophic and literary context followed by class discussion. Students keep a reading journal that examines the meanings of illness, the moral role of the physician, and the relevance of emotions, culture, faith, values, social realities, and life histories to patient care. Enrollment limited, restricted to medical and graduate students.
M. Montello
HST.940| Bioinformatics: Principles, Methods and Applications
(Same subject as 10.555J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 10.555J.
Gr. Stephanopoulos, I. Rigoutsos

HST.947 Medical Artificial Intelligence
(Subject meets with 6.034)
Prereq: 6.001
G (Spring)
5-3-4 H-LEVEL Grad Credit
An intensive introduction to artificial intelligence and its applications to problems of medical diagnosis, therapy selection, and monitoring and learning from databases. Subject meets with lectures and recitations of 6.034 in the spring term only. Its material is supplemented by additional readings and discussion sessions. Students are responsible for completing all homework assignments in 6.034 and for additional problems and/or papers. Subject is available for credit only to graduate students in HST.
P. H. Winston, T. Lozano-Perez

HST.949| Computational Evolutionary Biology
(Same subject as 6.877J)
Prereq: 6.046J, 6.047J, 7.36J, 6.807J, or HST.508; or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-3-6 H-LEVEL Grad Credit
See description under subject 6.877J.
R. C. Berwick

HST.950| Biomedical Computing
(Same subject as 6.872J)
Prereq: 6.034
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 6.872J.
P. Szolovits, I. Kohane, L. Ohno-Machado

HST.951| Biomedical Decision Support
(Same subject as 6.873J)
Prereq: 6.034 or HST.947; programming skills or permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Presents the main concepts of decision analysis, artificial intelligence, and predictive model construction and evaluation in the specific context of medical applications. Emphasizes the advantages and disadvantages of using these methods in real-world systems. Technical focus on decision analysis, knowledge-based systems (qualitative and quantitative), learning systems (including logistic regression, classification trees, neural networks), and techniques to evaluate the performance of such systems. Students produce a final project using the methods learned in the subject, based on actual clinical data. (Required for students in the master’s program in medical informatics, but open to other graduate students and advanced undergraduates.)
L. Ohno-Machado, P. Szolovits, S. Vinterbo

HST.958| Biomedical Information Technology
(Same subject as 2.771J, 20.453J)
Prereq: —
G (Fall)
3-0-9 H-LEVEL Grad Credit
See description under subject 20.453J.
C. F. Dewey, Jr., S. Bhownik (NTU, Singapore)

HST.959 Research Topics in Biomedical Informatics
Prereq: —
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Research methods and ideas involved in addressing the information needs of medical education, medical practice, and biomedical research. Topics include clinical information system design, medical knowledge representation, clinical decision making, cost effectiveness analysis, image management, software engineering, and evaluation approaches for information systems. Activities in various research groups are analyzed, and supplemented by readings and discussions. A written proposal and supervised project work are required.
R. A. Greenes, P. Szolovits, S. G. Pauker, I. Kohane, L. Ohno-Machado

HST.960| The Role of Physicians in Western Culture
(Subject meets with 21W.748)
Prereq: —
G (Spring)
2-0-4 [P/D/F]
Examines the changing attitudes toward physicians in western culture. Begins with a study of ancient Greek views on medicine and the role of its philosophy-trained physicians, moves on to the Middle Ages to assess the impact of Christianity on the public’s perception of doctors, and finally studies the changes wrought by the Enlightenment, secularization, industrialization and capitalism on western society’s attitudes toward doctors and their work. Ends with a discussion of the modern American views of doctors and the way these views shape the contemporary discussion of healthcare policy. Designed for students with an interest in medical and cultural history, literature and philosophy.
S. Klingenstein

HST.971| Strategic Decision Making in the Biomedical Business
(Same subject as 15.363J)
Prereq: —
G (Fall)
3-0-6
See description under subject 15.363J.
F. Murray

HST.973| Evaluating a Biomedical Business Concept
(Same subject as 15.124J)
Prereq: HST.971
G (Spring)
1-0-2 H-LEVEL Grad Credit
Critical analysis of new biomedical business ideas. Principals of early stage companies, or inventors, present their ideas and provide background material including scientific papers and patents. Teams of students evaluate each business idea. Students develop a series of analyses concerning the critical issues that each business idea would face. Issues may include efficacy of a technology, intellectual property protection, market opportunity, regulatory and reimbursement hurdles, competitive threats and potential return on investment. Students are encouraged to review scientific, clinical, patent and marketing literature as well as interview key individuals including principals, inventors, potential customers and competitors. Analyses focus on the issues most critical for the success of the proposed business concept. Offered second half of term.
R. J. Cohen, T. Dagi, C. Berke, E. Cannon

HST.975| Clinical Trials in Biomedical Enterprise
(Same subject as 15.121J)
Prereq: —
G (Fall)
2-0-4
Clinical trials have become one of the leading barriers to success in the introduction of new products and services for the healthcare industry. Subject enables healthcare managers to ask the important questions surrounding a decision to pursue a clinical trial. Deciding to participate in a clinical trial can sometimes result in expensive, long-term corporate commitments, which can have a significant impact on the company’s success or failure, particularly in the case of smaller companies. Subject explores issues related to determining whether a clinical trial is...
needed to significantly further the important goals of the company. Topics include the design, implementation, analysis and presentation of clinical trials. Case scenarios are presented by professionals in the field, and students are asked to develop their own Outline Plan and Clinical Trial Study Plan from the sample cases provided. Enrollment limited.

H. Golub

HST.977J Critical Reading and Technical Assessment of Biomedical Information
(Same subject as 15.122J)
Prereq: SB degree in Biological Science or permission of instructor
G (Spring)
1-0-2 H-LEVEL Grad Credit

Gain experience in critical reading of scientific literature with an emphasis on analyzing clinical controversies and emerging technologies in subject areas that have been or could become sources of entrepreneurial activity. Students required to analyze a variety of topics in the scientific literature, including screening for and cost-effectiveness of early detection of cancer, therapeutic opportunities in oncology, evaluation of immunotoxins and antibody therapies, and new prospects for the treatment of autoimmune disorders. To support the discussion of these topics, outside experts may be invited to participate as facilitators. Meets in first half of term.
S. Lapidus, S. Sengupta

HST.979J Dynamics of Biomedical Technologies
(Same subject as 15.123J)
Prereq: —
G (Fall, Spring)
2-0-1 [P/D/F]
Can be repeated for credit

Examines interrelationships between life science and technology developments in the context of six dynamic forces affecting the biomedical industrial sector. Considers these interrelationships through close investigation of one science or technology platform each semester. Case studies, upper-level executive presentations, and student group exercises focus discussion and in-depth analysis on industry structure, risk and economics, cost drivers and financing, markets, consumers and patients, the rapid evolution of related science and technology, public policy, accountability and ethics. Enrollment limited to 20.
A. J. Sinsky, F. Douglas, T. Dagi

HST.986–HST.989 Special Subjects in Biomedical Enterprise
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Opportunity for group study of advanced subjects relating to biomedical enterprise not otherwise included in the curriculum. Offerings are initiated by HST faculty on an ad hoc basis subject to program approval. Prerequisites may vary by topic. Consult faculty at time of offering.
J. E. Greenberg

HST.ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research leading to the writing of a PhD or ScD thesis or an HST SM thesis; to be arranged by the student and an appropriate MIT faculty advisor.
M. L. Gray

HST.URG Undergraduate Research in Health Sciences and Technology
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

Extended participation in the work of a faculty member or research group. Research is arranged by mutual agreement between the student and a member of the faculty of the Harvard-MIT Division of Health Sciences and Technology, and may continue over several terms. Registration requires submission of a written proposal, signed by the faculty supervisor. A summary report must be submitted at the end of each term.
H. F. Bowman
UNDERGRADUATE SUBJECTS

MAS.110 Fundamentals of Computational Media Design
Prereq: —
U (Fall) 3-3-6 HASS, CI-H

History of 20th-century art and design from the perspective of the technologist. Methods for visual analysis, oral critique, and digital expression are introduced. Limited enrollment.
J. Maeda

MAS.111 Introduction to Doing Research in Media Arts and Sciences
Prereq: —
U (Spring) 1-4-1 [P/D/F]

Intended for students pursuing research projects at the Media Laboratory. Topics include Media Lab research areas; documenting research progress; ethical issues in research; patents, copyrights, intellectual property; and giving oral, written, and online presentations of results. A final oral presentation is required. Enrollment limited with preference given to students in the Media Arts and Sciences freshman program.
V. M. Bove, Jr., Staff

MAS.160 Signals, Systems, and Information for Media Technology
(Subject meets with MAS.510, MAS.511)
Prereq: 18.02
Acad Year 2007–2008: U (Fall) Acad Year 2008–2009: Not offered 4-0-8

Fundamentals of signals and information theory with emphasis on modeling audio/visual messages and physiologically derived signals, and the human source or recipient. Linear systems, difference equations, Z-transforms, sampling and sampling rate conversion, convolution, filtering, modulation, Fourier analysis, entropy, noise, Shannon’s fundamental theorems. Additional topics may include data compression, filter design, and feature detection. Meets with MAS.510 and MAS.511 but assignments differ.
V. M. Bove, Jr., R. W. Picard

MAS.234j Perception, Knowledge, and Cognition
(Same subject as 9.34j)
Prereq: 9.00 or permission of instructor Acad Year 2007–2008: Not offered Acad Year 2008–2009: U (Fall) 3-0-6

See description under subject 9.34j.
W. A. Richards

MAS.235j Anigrafs
(Same subject as 9.37j)
Prereq: 9.34 or permission of instructor Acad Year 2007–2008: U (Fall) Acad Year 2008–2009: Not offered 3-0-9

See description under subject 9.37j.
W. Richards

MAS.241 Audio Processing by People and Machines
(Subject meets with 21M.566J, MAS.641J)
Prereq: Permission of instructor U (Fall) 3-0-6

See description under subject MAS.641J.
B. Vercoe

MAS.479 Special Projects at the Center for Advanced Visual Studies
Prereq: Permission of instructor U (Fall, Spring, Summer) Units arranged Special projects on group or individual basis. Registration subject to prior arrangement of subject matter and supervision by staff.
Staff

MAS.490 Special Projects in Media Arts and Sciences
Prereq: Permission of instructor U (Fall, Spring, Summer) Units arranged Can be repeated for credit

MAS.491 Special Projects in Media Arts and Sciences
Prereq: — U (Fall, Spring, Summer) Units arranged [P/D/F] Can be repeated for credit

Special projects on group or individual basis. Registration subject to prior arrangement of subject matter and supervision by staff.
Staff

MAS.UR Undergraduate Research in Media Arts and Sciences
Prereq: — U (Fall, Spring, Summer) Units arranged Can be repeated for credit

Individual or group study, research, or laboratory investigations under faculty supervision, including individual participation in an ongoing research project. See UROP coordinator for further information.
C. Schmandt

GRADUATE SUBJECTS

MAS.510 Signals, Systems, and Information for Media Technology
(Subject meets with MAS.160, MAS.511)
Prereq: 18.02 Acad Year 2007–2008: G (Fall) Acad Year 2008–2009: Not offered 2-0-4

Fundamentals of signals and information theory with emphasis on modeling audio/visual messages and physiologically derived signals, including sampling, sampling rate conversion, reconstruction, quantization, Fourier analysis,
entrophy, and noise. Shannon’s fundamental theorems. Meets the first half of the term with MAS.160, but assignments differ.

V. M. Bove, Jr., R. W. Picard

MAS.511 Systems and Signal Processing for Media Technology
(Subject meets with MAS.160, MAS.510)
Prereq: MAS.510, 6.003, or permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
2-0-4

Fundamentals of signal processing and linear systems theory as applied to audio/visual messages and physiologically-derived signals. Linear systems, difference equation, Z-transforms, convolution, filtering. Additional topics may include filter design, feature detection, communication systems. Meets the second half of the term with MAS.160, but assignments differ.

V. M. Bove, Jr., R. W. Picard

MAS.551 Design Without Boundaries (New)
Prereq: —
G (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

Provides opportunities to pursue real-world design projects that cross traditional disciplinary boundaries, apply advanced technologies, and address significant social issues. Among the projects to be explored are the design of a smart village in Zambian Italy, continuation of the eLens mobile communication project, continuation of the Paris bus system project, and the development of new types of urban personal transportation systems. Students are expected to contribute to conceptualization, development, modeling, and prototyping of one of the projects.

W. Mitchell, F. Casalegno

MAS.622 Pattern Recognition and Analysis
(Same subject as 1.126)
Prereq: A working knowledge of probability theory and linear algebra
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Fundamentals of characterizing and recognizing patterns and features of interest in numerical data. Basic tools and theory for signal understanding problems with applications to user modeling, affect recognition, speech recognition and understanding, computer vision, physiological analysis, and more. Decision theory, statistical classification, maximum likelihood and Bayesian estimation, nonparametric methods, unsupervised learning and clustering. Additional topics on machine and human learning from active research. Enrollment limited.

R. W. Picard

MAS.630 Affective Computing
Prereq: Permission of instructor
G (Spring)
2-0-10 H-LEVEL Grad Credit

Explores computing that relates to, arises from, or deliberately influences emotion. Topics include the interaction of emotion with cognition and perception; the role of emotion in human-computer interaction; the communication of human emotion via face, voice, physiology, and behavior; construction of computers that have skills of emotional intelligence; the development of computers that “have” emotion; and other areas of current research interest. Weekly reading, discussion, and a term project required. Enrollment limited.

R. W. Picard

MAS.632 Speech Interfaces and Mobile Devices
Prereq: Permission of instructor
G (Fall)
Units arranged H-LEVEL Grad Credit

Interaction with mobile computing systems and telephones by voice, including speech synthesis, recognition, digital recording, and browsing recorded speech. Emphasis on human interface design issues and interaction techniques appropriate for cognitive requirements of speech. Topics include human speech production and perception, speech recognition and text-to-speech algorithms, telephone networks, and spatial and time-compressed listening. Extensive reading from current research literature.

C. Schmandt

MAS.641 Audio Processing by People and Machines
(Same subject as 21M.566)
(Subject meets with MAS.241)
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

Principles of information processing by the human auditory system, from detection of frequency, intensity, and spectrum, to the development of their perceptual correlates as pitch, loudness, and timbre. Machine models of the human auditory and musical experience using perceptually based sensor and interpreter constructs, sufficient to enable machines to experience sound and music in a manner related to our own. Exploring auditory and music cognition with the aid of real-time audio processors. Modeling musical common sense. Lectures same as MAS.241, with additional readings and a group or individual project.

B. Vercoe

MAS.642] Writing for Computer Performance
(Same subject as 21M.565)
Prereq: MAS.641
G (Spring)
3-0-6 H-LEVEL Grad Credit

Use of current tools and techniques for creating audio soundtracks that can be synthesized by computer in real time. Techniques of compact definition and efficient, global dissemination, such as via the Web. Development and use of global standards for audio and music rendering on remote sites. Participants are expected to create an original work, performed in at least three remote sites to positive commentary, using the above principles.

B. Vercoe

MAS.654] Cognitive Architectures
(Same subject as 9.343)
Prereq: Permission of instructor
G (Fall)
3-3-6 H-LEVEL Grad Credit

See description under subject 9.343.

W. A. Richards

MAS.664 Digital Innovations
Prereq: —
G (Fall)
3-0-6

Can be repeated for credit

Seminar surveying the blossoming arena of social software, particularly applications based on smart phones. Explore the possibilities of this technology through research testbeds, which are systematically deployed research lab prototypes that attempt to shape human behavior and communication in organizations while systematically observing the (often unexpected) social consequences. All students are expected to participate in the exploratory phase of one of the technology testbed projects; form teams to design novel experimental tools/artifacts and/or applications; run at least one rigorous experiment; and write a summary project report.

A. Pentland

MAS.665 Developmental Entrepreneurship
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Develop innovative business plans for the 1K competition in the area of social innovation/sustainable development. Students form teams of four, usually including both technology and
business students, to repeatedly devise and
revise business plans that use innovations in
technology and organization to create busi-
besses that can transform the lives of at least 1B
people. Enrollment limited to 25.
A. Pentland

MAS.672 New Paradigms for Human-Computer Interaction
Prereq: Permission of instructor
G (Spring)
2-8-2 H-LEVEL Grad Credit
Focuses on radically novel approaches to hu-
man-computer interaction. Read and discuss
seminal papers from the fields of ubiquitous
computing, mixed reality, augmented reality,
wearables, location-aware computing, ambient
intelligence, ambient interfaces, tangible
interfaces, e-textiles, smart networked objects,
intelligent interfaces, sentient architecture,
software agents and others. Students required
to participate in the discussion of the weekly
readings, to engage in the design of several ap-
plications and to complete one larger design and
implementation project. Limited to 16 students.
P. Maes

MAS.690 Special Projects in Media Arts and Sciences
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Special projects on individual or group basis.
Registration subject to prior arrangement of
subject matter and supervision by staff.
Staff

MAS.712 Special Topics in Creative Learning Technologies
Prereq: Permission of instructor
G (Spring)
2-0-7 H-LEVEL Grad Credit
Can be repeated for credit
Project-oriented subject focuses on current
research in innovative educational technologies
and creative learning environments. Students
contribute directly to ongoing research projects
through design activities and field tests. Stu-
dents work in groups on final project.
M. Resnick

MAS.714J Technologies for Creative Learning
(Same subject as STS.445J)
Prereq: Permission of instructor
G (Fall)
2-0-7 H-LEVEL Grad Credit
Explores the design of innovative educational
technologies and creative learning environ-
ments, drawing on specific case studies such as
the LEGO Programmable Brick, Scratch software
and Computer Clubhouse after-school learning
centers. Includes activities with new educa-
tional technologies, reflections on learning
experiences, and discussion of strategies and
principles underlying the design of new tools and
activities.
M. Resnick

MAS.720 Meaning Machines
Prereq: —
G (Spring)
3-0-6
Examines aspects of knowledge representation
and language use by machines and humans.
Emphasizes how linguistic meaning is grounded
in non-linguistic physical and social context.
Ideas from semiotics, philosophy of mind, and
cognitive psychology are brought together with
methods from computer science and systems
engineering. A final project requiring implemen-
tation of a grounded semantics for a symbolic
communication system provides hands-on
experience with ideas discussed in class.
D. Roy

MAS.731J The Society of Mind
(Same subject as 6.868J)
Prereq: Must have read The Society of Mind,
permission of instructor
G (Spring)
2-0-10 H-LEVEL Grad Credit
See description under subject 6.868J.
M. Minsky

MAS.741 Context Aware Computing
Prereq: Permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit
Project-based subject teaches students to create
context-aware and intention-based computing
systems. Most computing systems have required
people to communicate with them using direc-
tives. Students use artificial intelligence (AI)
and sensors to create computing systems that figure
out what to do based on sensors and virtual
sensors. The system’s physical and symbolic
actions may be dependent on time, place, or the
history of interaction. Students explore perspec-
tives from machine learning, sensors, embedded
devices, information visualization, philosophy,
and psychology. Students see how each treats
the problem of context, and discuss the implica-
tions for design of context-sensitive hardware
and software. Requires presentations and
critiques of class readings and a final project,
including a computer implementation evaluation
and publication of a quality paper.
T. Selker, H. Lieberman

MAS.742 Industrial Design Intelligence: A Cognitive Approach to Engineering
Prereq: Permission of instructor
G (Fall)
3-7-2 H-LEVEL Grad Credit
Cognitive science and technology applied to the
industrial design process. Introduces prototyp-
ing techniques and approaches for objective
evaluation as part of the design process. Stu-
dents practice evaluating products with mechanical
and electronic aspects. Evaluation process is
applied to creating functioning smart product
prototypes. Project oriented subject that draws
upon engineering, aesthetic, and creative skills.
Geared toward students interested in creating
physical products that encompass electronics
and computers in order to include them in smart
scenarios. Students present readings, learn
prototyping skills, create a product prototype,
and complete a publication-style paper.
T. Selker

MAS.750 Human-Robot Interaction
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-7 H-LEVEL Grad Credit
In-depth exploration of the leading research,
design principles, and technical challenges in
human-robot interaction (HRI), with an emphasis
on socially interactive robots. Topics include
mixed-initiative interaction, situational aware-
ness, multi-modal interfaces and communica-
tion, human-robot teamwork, social learning, as-
pects of social cognition, long-term interaction,
and evaluation with human subjects. Requires
presentations and critiques of class readings,
student projects, and a final project including
publication of a quality paper.
C. Breazeal

MAS.751J Relational Machines
(Same subject as STS.447J)
Prereq: Permission of instructor
G (Spring)
2-0-7 H-LEVEL Grad Credit
Introduction to the issues, principles, and chal-
enges toward building relational machines:
technological artifacts that are designed to
inspire a sense of relationship in their users. Sample applications include learning companions for children, assistive robots for the elderly, software agents that act as trainers or assistants, interactive game characters that engage in social relationships, or machines that cooperate with humans as members of human-robot teams. Readings cover a broad range of topics from psychology, sociology, and human-computer/robot interaction as well as how these ideas manifest in a wide range of applications for technological systems. Requires presentations and critiques of class readings and a final project that includes writing a scholarly paper.

C. Breazeal, S. Turkle

MAS.761 Common Sense Reasoning for Interactive Applications (New)
Prereq: —
G (Fall)
3-0-9
Explores the state of the art in common sense knowledge, and class projects design and build interfaces that can exploit this knowledge to make more usable and helpful interfaces. Enrollment limited to 25.
H. Lieberman

MAS.790 Special Projects in Media Arts and Sciences
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Special projects on individual or group basis. Registration subject to prior arrangement of subject matter and supervision by staff.
Staff

MAS.825J Musical Aesthetics and Media Technology
(Same subject as 21M.580J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-3-3 H-LEVEL Grad Credit
In-depth exploration of contemporary concepts in music and media. Studies recent music that uses advanced technology, and the artistic motivations and concerns implied by the new media. Practical experience with computer music technology, including MIDI and post-MIDI systems. Special emphasis on the interactive systems for professionals as well as amateurs. Midterm paper and term project required.
T. Machover

MAS.826J Projects in Media and Music
(Same subject as 21M.581J)
Prereq: MAS.825J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-3-6 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor
Current computer music concepts and practice. Project-based work on research or production projects using the Media Lab’s computer music, interactive, and media resources. Requires significant studio work and a term project. Projects based on class interests and skills, and may be individually or group-based.
T. Machover

MAS.834 Tangible Interfaces
Prereq: Permission of instructor
G (Fall)
3-3-6 H-LEVEL Grad Credit
Explores design issues surrounding tangible user interfaces, a new form of human-computer interaction. Tangible user interfaces seek to realize seamless interfaces between humans, digital information, and the physical environment by giving physical form to digital information and computation, making bits directly manipulable with hands and perceptible at the periphery of human awareness. In the design studio environment, students explore experimental tangible interface designs, theories, applications, and underlying technologies, using concept sketches, posters, physical mockups, and working prototypes.
H. Ishii

MAS.836 Sensor Technologies for Interactive Environments
Prereq: Permission of instructor
G (Spring)
3-3-6 H-LEVEL Grad Credit
A broad introduction to a host of sensor technologies, illustrated by applications drawn from human-computer interfaces and ubiquitous computing. After extensively reviewing electronics for sensor signal conditioning, the lectures cover the principles and operation of a variety of sensor architectures and modalities, including pressure, strain, displacement, proximity, thermal, electric and magnetic field, optical, acoustic, RF, inertial, and bioelectric. Simple sensor processing algorithms and wired and wireless network standards are also discussed. Students complete written assignments, a set of laboratories, and a final project.
J. Paradiso

MAS.837 Principles of Electronic Music Interfaces (New)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Explores the ways in which electronic music is controlled and performed. A solid historical perspective is presented, tracing the development of various families of electronic musical controllers and instruments from their genesis in the late 1800s onwards. Design principles and engineering detail is also given for various current and classic controllers. Involves lively discussion of evolving issues in the control of computer music for live performance and interactive installations, including computer mapping of sensor signals and transduced gesture onto sound, music, and other media. Weekly reading assignments are given, and a final project or paper is required.
J. Paradiso

MAS.845 Special Topics in Cinematic Storytelling
Prereq: Permission of instructor
G (Spring)
Units arranged H-LEVEL Grad Credit
Seminar explores approaches to representation for very distributed cinematic storytelling. The relationship between story creation and story appreciation is analyzed. Readings are drawn from literary, cinematic criticism, as well as from descriptions of interactive, distributed works. Students analyze a range of storytelling techniques; develop a proposal using visualization techniques, and prototype a working story experience. Individual or group final projects.
G. Davenport

MAS.849 Special Topics in Multimedia Production
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Individual or group work of advanced and experimental scope. Registration contingent upon prior determination of subject matter and plan for treatment, as well as arrangement for staff supervision and project funding.
G. Davenport
MAS.857J Optical Engineering
(Same subject as 2.717J)
Prereq: 2.710 or permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 2.717J.
P. T. So, G. Barbastathis
MAS.858 Creative Holography Workshop
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-3-3
An introduction to the history, methods, and aesthetics of holographic image making. Students create holograms in the lab on a weekly basis, learning to use holography as a medium of expression and as a tool for the investigation of three-dimensional ideas in design, architecture, environmental design, and engineering studies. Lab fee. Enrollment limited.
B. Connors
MAS.862 The Physics of Information Technology
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Familiar devices that collect, store, manipulate, transmit, and present electronic information operate near profound fundamental physical limits. Subject provides a self-contained introduction to the governing equations in a range of relevant domains, and then studies operational device principles in order to understand how they work, how they can be used, what the limits on their performance are, and how they might be improved. Following a review of the foundations of thermodynamics and noise, electromagnetics, and the quantum description of materials, the device applications include semiconductor logic, magnetic storage, wireless and optical communications, and quantum information and computation.
N. Gershenfeld
MAS.863 How to Make (Almost) Anything
Prereq: Permission of instructor
G (Fall)
3-9-0
Provides a hands-on introduction to the resources for designing and fabricating smart systems, including CAD/CAM/CAE; NC machining, 3-D printing and scanning, injection molding, laser and waterjet cutting; PCB layout and fabrication; sensors and actuators; analog instrumentation; embedded digital processing; wired and wireless communications. Emphasis on learning how to use the tools as well as understand how they work.
N. Gershenfeld, J. DiFrancesco
MAS.864 The Nature of Mathematical Modeling
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Surveys the range of levels of description useful for the mathematical description of real and virtual worlds, including analytical solutions and approximations for difference and differential equations; finite difference, finite element and cellular automata numerical models; and stochastic processes, nonlinear function fitting and observational model inference. Emphasis on efficient practical implementation of these ideas.
N. Gershenfeld
MAS.865J Quantum Information Science
(Same subject as 6.443J, 8.371J)
Prereq: 2.11 or 8.05; 6.050 J or 18.06
G (Spring)
3-0-9 H-LEVEL Grad Credit
Examines quantum computation and quantum information. Topics include quantum circuits, quantum Fourier transform and search algorithms, physical implementations, the quantum operations formalism, quantum error correction, stabilizer and Calderbank-Shor-Steans codes, fault tolerant quantum computation, quantum data compression, entanglement, and proof of the security of quantum cryptography. Prior knowledge of quantum mechanics and basic information theory is required.
I. Chuang
MAS.879 Special Topics in the Center for Advanced Visual Studies
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Special projects on group or individual basis. Registration subject to prior arrangement of subject matter and supervision by staff.
Staff
General
MAS.910 Research in Media Technology
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
For research assistants in Media Arts and Sciences, where the assigned research is approved for academic credit by the department.
Staff
MAS.912 Teaching in Media Arts and Sciences
Prereq: —
G (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit
Laboratory, tutorial, or classroom teaching under the supervision of a Media Arts and Sciences faculty member. Students selected by interview. Enrollment is limited by the availability of suitable teaching assignments.  
Staff

MAS.921 Proseminar in Media Arts and Sciences
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Designed specifically for new doctoral students in the Media Arts and Sciences (MAS) program. Explores intellectual foundations of MAS, unifying themes connecting MAS research, and working practices of MAS researchers. Students discuss foundational papers, critique current MAS research, and work on collaborative projects related to key MAS themes. Restricted to MAS doctoral students.  
Staff

MAS.940 Preparation for SM Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Selection of thesis topic, definition of method of approach, and preparation of thesis proposal. Independent study supplemented by individual conferences with faculty. In some cases, coregistration with 21W.793 or equivalent required.  
A. Lippman

MAS.945 Preparation for General Exams
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
0-12-0 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
Selected readings for Media Arts and Sciences doctoral students in preparation for their qualifying exams.  
Staff

MAS.950 Preparation for PhD Thesis
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Selects thesis subject, defines method of approach, and prepares preliminary thesis outline. Independent study, supplemented by frequent individual conferences with staff members. Restricted to doctoral candidates.  
Staff

MAS.960 Special Topics in Media Technology
Prereq: Permission of instructor
G (Fall, IAP, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

MAS.961–MAS.968 Special Topics in Media Technology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Supplementary work on individual or group basis. Registration subject to prior arrangement for subject matter and supervision by staff.  
Staff

MAS.ThG Graduate Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Program of research and writing of thesis; to be arranged by the student with supervising committee.  
Staff
2007–2008

3 P a r t

664

D. R. Wallace, D. D. Frey


2.00A) Fundamentals of Engineering Design: Explore Space, Sea and Earth
(Same subject as 16.00A)
Prereq: 8.01, 18.01
U (Spring)
2-3-3

Students teams formulate and complete space/earth/ocean exploration-based design projects with weekly milestones. Introduces core engineering themes, principles, and modes of thinking. Specialized learning modules enable teams to focus on the knowledge required to complete their projects, such as machine elements, electronics, design process, visualization and communication. Includes exercises in written and oral communication and team building. Examples of projects include surveying a lake for milfoil, from a remote controlled aircraft, and then sending out robotic harvesters to clear the invasive growth; and exploration to search for the evidence of life on a moon of Jupiter, with scientists participating through teleoperation and supervisory control of robots. Limited enrollment. Preference to freshmen.


2.00B Solving Real Problems
Prereq: —
U (Spring)
2-3-4

Solve real problems in a project-centric class with 5 labs, each focusing on a different project theme and working directly with the potential beneficiaries of your work. Improve problem-solving skills while working on projects ranging from toys for children to amusement park rides and products for use in developing countries. Students select a project-themed lab in conjunction with subject. Develop creativity, visualization, mathematical estimation and modeling, prototyping, and team management techniques that help with the project. Includes exercises in written and oral communication and team building. Limited enrollment. Preference to freshmen.

D. R. Wallace, D. D. Frey

4.001) CityScope
(Same subject as 11.004)
Prereq: —
U (Spring)
3-0-9 HASS

Project-based introduction to the contemporary city as a complex system within a context of limited resources and competing interests. Learn to assess scenarios for the purpose of formulating social, economic and design strategies that provide optimized solutions that are humane and sustainable. Group projects develop and advocate visions for housing, urban planning, regeneration of natural ecologies and other sectors of the city. During spring break the class visits New Orleans, the focus of Cityscope in 2007. This trip is funded, and not required. Includes exercises in written and oral communication and team building. Limited to 15 participants. Preference to freshmen.

J. Fernandez, P. Thompson

5.92 Energy, Environment, and Society
Prereq: Permission of instructor
U (Spring)
4-2-6

Explores energy issues and community dynamics at the local level: on the MIT campus and in the cities of Cambridge and Boston. Staff in the Laboratory for Energy and the Environment work with community contacts to develop project ideas of concern to community leaders that have potential to affect local energy management. Students are involved in all aspects of project design, from the refinement of research questions to conclusions and presentation of findings. Includes exercises in written and oral communication and team building. Limited enrollment. Preference to freshmen.

J. I. Steinfeld, J. W. Tester

6.07) Projects in Microscale Engineering for the Life Sciences
(Same subject as HST.410)
Prereq: —
U (Spring)
2-4-3

A project-based introduction to manipulating and characterizing cells and biological molecules using microfabricated tools. In the first half of the term, students perform laboratory exercises designed to introduce the design, manufacture, and use of microfluidic channels; techniques for sorting and manipulating cells and biomolecules; and making quantitative measurements using optical detection and fluorescent labeling. In the second half of the term, students work in small groups to design and test a microfluidic device to solve a real-world problem of their choosing. Includes exercises in written and oral communication and team building. Enrollment limited to 20 students. Preference to freshmen.

D. Freeman, M. Gray, A. Aranyosi

11.004) CityScope
(Same subject as 4.001)
Prereq: —
U (Spring)
3-0-9 HASS

See description under subject 4.001). Limited to 15 participants. Preference to freshmen.

J. Fernandez, P. Thompson

12.000 Solving Complex Problems
Prereq: —
U (Fall)
1-2-6

Provides an opportunity for entering freshmen to gain first-hand experience in integrating the work of small teams to develop effective solutions to complex problems in Earth system science and engineering. Each year’s class explores a different problem in detail through the study of complementary case histories and the development of creative solution strategies. Includes exercises in website development, written and oral communication, and team building. Subject required for students in the Terrascope freshman program, but participation in Terrascope is not required of all 12,000 students. Students who pass 12.000 and are in the Terrascope program are eligible to participate in the Terrascope field trip the following spring. Enrollment limited to freshman.

K. Hodges, R. Bras

2007–2008
**16.00 Introduction to Aerospace and Design**

Prereq: —
U (Spring)
3-1-5

The fundamental concepts and approaches of aerospace engineering are highlighted through lectures on aeronautics, astronautics, and design. Active learning aerospace modules make use of information technology. Student teams are immersed in a hands-on, lighter-than-air (LTA) vehicle design project where they design, build, and fly radio-controlled LTA vehicles. The connections between theory and practice are realized in the design exercises. Required design reviews precede the LTA race competition. The performance, weight, and principle characteristics of the LTA vehicles are estimated and illustrated using physics, mathematics, and chemistry known to freshmen, the emphasis being on the application of this knowledge to aerospace engineering and design rather than on exposure to new science and mathematics. Includes exercises in written and oral communication and team building.

*J. A. Hoffman, P. W. Young*

**16.00A) Fundamentals of Engineering Design: Explore Space, Sea and Earth**

(Same subject as 2.00A)

Prereq: 8.01, 18.01
U (Spring)
3-3-3

See description under subject 2.00A.

*A. H. Techet, A. H. Slocum, D. Newman, E. F. Crawley*

**20.020 Introduction to Biological Engineering Design (New)**

Prereq: —
U (Spring)
2-6-4

A project-based introduction to the engineering of synthetic biological systems. Throughout the term, students develop projects that are responsive to real-world problems of their choosing, and whose solutions depend on biological technologies. Lectures, discussions, and studio exercises will introduce (1) components and control of prokaryotic and eukaryotic behavior, (2) DNA synthesis, standards, and abstraction in biological engineering, and (3) issues of human practice, including biological safety; security; ownership, sharing, and innovation; and ethics. Preference to freshmen.

*D. Endy, N. Kuldell*
AEROSPACE STUDIES

AS.101 The Foundations of the United States Air Force
Prereq: AS.111
U (Fall)
1-0-1
AS.102 The Foundations of the United States Air Force
Prereq: AS.101 or permission of instructor;
AS.112
U (Spring)
1-0-1
Survey designed to introduce students to the US Air Force and Air Force Reserve Officer Training Corps. Topics include mission and organization of the Air Force, officership and professionalism, military customs and courtesies, Air Force officer opportunities, group leadership problems, and an introduction to communication skills. AS.102 is a continuation of AS.101.
K. Hort

AS.111 Leadership Laboratory
Prereq: AS.101
U (Fall)
0-2-2 [P/D/F]
AS.112 Leadership Laboratory
Prereq: AS.111 or permission of instructor;
AS.102
U (Spring)
0-2-2 [P/D/F]
Includes a study of Air Force customs and courtesies, drill and ceremonies, and military commands. Also includes studying the environment of an Air Force officer and learning about areas of opportunity available to commissioned officers, as well as interviews, guidance, and information to increase the understanding, motivation, and performance of other cadets. AS.112 is a continuation of AS.111.
M. Keller

AS.201 The Evolution of USAF Air and Space Power
Prereq: AS.102 or permission of instructor;
AS.211
U (Fall)
1-0-1
AS.202 The Evolution of USAF Air and Space Power
Prereq: AS.201 or permission of instructor;
AS.212
U (Spring)
1-0-1
Survey designed to facilitate the transition from Air Force ROTC cadet to Air Force ROTC officer candidate. Topics include Air Force heritage and leaders, Quality Air Force, an introduction to ethics and values, introduction to leadership, group leadership problems, and continuing application of communication skills. AS.202 is a continuation of AS.201.
T. Slauenwhite

AS.211 Leadership Laboratory
Prereq: AS.112 or permission of instructor;
AS.201
U (Fall)
0-2-4 [P/D/F]
AS.212 Leadership Laboratory
Prereq: AS.211 or permission of instructor;
AS.202
U (Spring)
0-2-4 [P/D/F]
Consists of activities classified as advanced leadership experiences that involve the planning and controlling of military activities of the cadet corps and the preparation and presentation of briefings and other oral and written communications. Also includes interviews, guidance, and information to increase the understanding, motivation, and performance of other cadets. AS.212 is a continuation of AS.211.
M. Keller

AS.301 Air Force Leadership Studies
Prereq: AS.202 or permission of instructor;
AS.311
U (Fall)
3-0-3
AS.302 Air Force Leadership Studies
Prereq: AS.301 or permission of instructor;
AS.312
U (Spring)
3-0-3
Study of leadership, quality management fundamentals, professional knowledge, Air Force doctrine, leadership ethics, and communication skills required of an Air Force junior officer. Case studies are used to examine Air Force leadership and management situations as a means of demonstrating and exercising practical application of the concepts being studied. AS.302 is a continuation of AS.301.
M. Keller

AS.311 Leadership Laboratory
Prereq: AS.212 or permission of instructor;
AS.301
U (Fall)
0-2-4 [P/D/F]
AS.312 Leadership Laboratory
Prereq: AS.311 or permission of instructor;
AS.302
U (Spring)
0-2-4 [P/D/F]
Consists of activities classified as advanced leadership experiences that involve the planning and controlling of military activities of the cadet corps and the preparation and presentation of briefings and other oral and written communications. Also includes interviews, guidance, and information to increase the understanding, motivation, and performance of other cadets. AS.312 is a continuation of AS.311.
M. Keller

AS.401 National Security Affairs/Preparation for Active Duty
Prereq: AS.302 or permission of instructor;
AS.411
U (Fall)
3-0-9
AS.402 National Security Affairs/Preparation for Active Duty
Prereq: AS.401 or permission of instructor;
AS.412
U (Spring)
3-0-3
Examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. Special topics of interest focus on the military as a profession, officership, military justice, civilian control of the military, preparation for active duty, and current issues affecting military professionalism. Within this structure,
continued emphasis on refining communication skills. AS.402 is a continuation of AS.401.

T. Slauenwhite

**AS.411 Leadership Laboratory**
Prereq: AS.312 or permission of instructor; AS.401
U (Fall)
0-2-4 [P/D/F]

**AS.412 Leadership Laboratory**
Prereq: AS.411 or permission of instructor; AS.402
U (Spring)
0-2-4 [P/D/F]

Consists of activities classified as advanced leadership experiences that involve the planning and controlling of military activities of the cadet corps, and the preparation and presentation of briefings and other oral and written communications. Also includes interviews, guidance, and information to increase the understanding, motivation, and performance of other cadets. AS.412 is a continuation of AS.411.

M. Keller

**MILITARY SCIENCE**

**MS.101 Introduction to the Army**
Prereq: —
U (Fall)
1-2-1

Investigates the structure and employment of the military across the spectrum of current missions. Provides the framework of officership as it relates to leadership, management responsibilities, and communication skills necessary to be successful as an Army officer. Teaches basic soldier skills to include land navigation and weapons familiarity. Includes a study of the Army customs and traditions as well as career opportunities available to commissioned officers.

C. Neal

**MS.102 Fundamental Military Skills**
Prereq: MS.101 or permission of instructor
U (Spring)
1-2-1

Introduces students to values and characteristics of effective leaders such as honor, integrity, ethics and the Be-Know-Do framework. Case studies and historical events are used to examine the principles of leadership. Teaches basic soldier skills to include rifle marksmanship, first aid, and drill/ceremony. Identifies soldier specialty skills and their role in operational unit missions.

C. Neal

**MS.201 Introduction to Leadership**
Prereq: MS.102 or permission of instructor
U (Fall)
2-1-1

Analysis of leadership factors, principles, and study of leader traits. Development of decision-making process. Emphasis on communicating purpose, direction, and motivation to subordinates. Stresses oral presentations in military format and development of written combat operations orders.

M. Chaney

**MS.202 Intermediate Military Skills**
Prereq: MS.201 or permission of instructor
U (Spring)
2-1-1

Discussion of situational exercises in leading troops. Practice methods of instructing individual skills. Exposure to doctrinal tactics for small units (squad level). Advanced navigational techniques and terrain analysis for military operations. Employs sandtables for use in course of action development.

M. Chaney

**MS.301 Small Unit Tactics**
Prereq: MS.202 or permission of instructor
U (Fall)
3-0-1

Examines leadership of small units conducting conventional combat operations and tactical employment of weapon systems. Elements of terrain analysis and weather considerations applicable to offensive, defensive, and retrograde operations discussed. Continued development of oral communication skills through military briefings and issuance of OPORDs.

D. Gowel, K. Karwowski

**MS.302 Advanced Military Science**
Prereq: MS.301
U (Spring)
3-0-1

Organizational structure and related MTOE equipment in tactical combined-arms and joint operations. Discussion of roles and functions of combat arms, combat support, and combat service support branches. Case studies of small-unit operations. Introduction to Army special operations, operations other than war, and trends in the military.

D. Gowel, K. Karwowski

**MS.311 Leadership Laboratory I**
Prereq: MS.301; MS.202 or permission of instructor
U (Fall)
0-2-1

Collective training in fundamentals of small unit tactics, drill and ceremony, and the practice of individual military skills under field conditions off campus. Includes one weekend of field adventure training focused on teambuilding through completion of leaders reaction course, obstacle course, marksmanship, and rappelling.

D. Gowel, K. Karwowski

**MS.312 Leadership Laboratory II**
Prereq: MS.302, MS.311
U (Spring)
0-1-2

Continues development of skills taught in MS.311. Training focus prepares student for ROTC Advanced Camp the following summer. Provides multiple venues for cadet evaluation under Leadership Development Program. Culminates in weekend Field Training Exercise practicing platoon tactics, land navigation, command and control, and patrolling. Opportunities exist for airborne school, air assault, voluntary winter survival, and advanced marksmanship training.

D. Gowel, K. Karwowski

**MS.401 Leadership and Management I**
Prereq: MS.302
U (Fall)
3-0-6

Develops cadet proficiency in planning, executing, and assessing complex operations, functioning as a member of a staff, and providing leadership performance feedback to subordinates. Cadets are given situational opportunities to assess risk, make ethical decisions, and provide coaching to fellow ROTC cadets. Cadets are challenged to analyze, evaluate, and instruct younger cadets. Both their classroom and battalion leadership experiences are designed to prepare them to operate effectively as Army officers. Cadets identify responsibilities of key staff, coordinate staff roles, and use situational opportunities to teach, train, and develop subordinates. At the end of the term, cadets should possess the fundamental skills, attributes, and abilities to operate as competent leaders in the cadre battalion and confidently communicate to subordinate cadets. Includes a Leadership Lab which reinforces the lessons learned in the classroom.

L. McGonagle

L. McGonagle

L. McGonagle
MS.402 Leadership and Management II
Prereq: MS.401
U (Spring)
3-0-2
Continuation of MS.401. Intended to prepare the cadets for a smooth transition into the officer corps. Explores topics ranging from officer evaluation and promotion system, army supply system, budget management, current threat analysis, security measures, and contemporary military issues. Student research and briefings on soldier support topics required.
L. McGonagle

MS.411 Advanced Leadership Laboratory I
Prereq: MS.401/15.305, MS.312
U (Fall)
0-1-3
Designed to develop the cadets’ technical, tactical, and leadership skills while continually assessing their officership potential. Through assignment to leadership positions in both command and staff capacities, cadets actively participate in the planning and execution of training within the program, directing and controlling the corps of cadets, enhancing oral and written communications and application of the battle focus planning process.
L. McGonagle

MS.412 Advanced Leadership Laboratory II
Prereq: MS.411
U (Spring)
0-1-4
Continuation of MS.411. Includes preparation for the transition from cadet/student to lieutenant.
L. McGonagle

NAVAL SCIENCE

NS.101 Introduction to Naval Science
Prereq: —
U (Fall)
2-0-1
Introduction to naval science. General introduction to the US Navy and Marine Corps. Emphasizes organizational structure, warfare components, and assigned roles/missions of US Navy/USMC. Covers all aspects of naval service from its relative position within DOD, to specific warfare communities/career paths. Also includes basic elements of leadership/Naval core values. Designed to give student initial exposure to many elements of naval culture. Provides students with conceptual framework and working vocabulary.
Staff

NS.102 Naval Ships Systems
Prereq: —
U (Spring)
3-0-3
Lecture series on technological fundamentals of applied and planned naval ships Systems from an engineering viewpoint. Topics include stability, propulsion, ship control and systems.
Staff

NS.200 Naval Science Leadership Seminar
(Subject meets with NS.100, NS.300, NS.400)
Prereq: —
U (Fall, Spring)
0-2-2 [P/D/F]
See description under subject NS.100.
Staff

NS.201 Naval Weapons Systems
Prereq: 8.01, 18.02 recommended
U (Fall)
3-0-3
Overview of the properties and behavior of electromagnetic radiation pertaining to maritime applications. Topics include communications, radar detection, electro-optics, tracking and guidance systems. Sonar and underwater sound propagation also discussed. Examples taken from systems found on naval ships and aircraft. Selected readings on naval weapons and fire control systems.
Staff

NS.202 Seapower and Maritime Affairs
Prereq: —
U (Spring)
2-0-2
A study of the US Navy and the influence of sea power upon history. Incorporates both a historical and political science process to explore the major events, attitudes, personalities, and circumstances which have imbued the US Navy with its proud history and rich tradition. Deals with issues of national imperatives in peacetime as well as war, varying maritime philosophies which were interpreted into naval strategies/doctrines, budgetary concerns which shaped force realities, and the pursuit of American diplomatic objectives, concluding with the current search for direction in the post–Cold War era and beyond.
Staff

NS.300 Naval Science Leadership Seminar
(Subject meets with NS.100, NS.200, NS.400)
Prereq: —
U (Fall, Spring)
0-2-2 [P/D/F]
See description under subject NS.100.
Staff

NS.301 Coastal Piloting and Celestial Navigation
Prereq: Recommended second class cruise
U (Fall)
2-0-2
Comprehensive study of the theory, principles, and procedures of piloting and celestial navigation, including mathematics of navigation, practical work involving navigational instruments, sight reduction by pro forma and computerized methods, charts, publications, and voyage planning.
Staff

NS.302 Navigation and Naval Operations
Prereq: Recommended second class cruise and NS.301
U (Spring)
3-0-3
Comprehensive study of tactical and strategic considerations to the employment of naval forces, including communications, tactical formations and dispositions, relative motion, maneuvering board, and nautical rules of the road.
Staff
NS.310 Evolution of Warfare  
Prereq: —  
U (Fall)  
2-0-4  
Traces development of warfare from dawn of recorded history to present, focusing on the impact of major military theorists, strategists, tacticians, and technological developments. Seeks to understand the relationships between military training, weaponry, strategies and tactics, and the societies and cultures that produce and then are defended by those military structures. By examining the association between a society and its military, students acquire basic sense of strategy, develop an understanding of military alternatives, and see the impact of historical precedents on military thoughts and actions.  
Staff

NS.400 Naval Science Leadership Seminar  
(Subject meets with NS.100, NS.200, NS.300)  
Prereq: —  
U (Fall, Spring)  
0-2-2 [P/D/F]  
See description under subject NS.100.  
Staff

NS.401 Leadership and Management I  
Prereq: NS.101  
U (Fall)  
3-0-3  
Explores leadership from the military perspective taught by professors of military science from the Army, Navy and Air Force. Survey of basic principles for successfully managing and leading people, particularly in public service and the military. Develops skills in topics such as oral and written communication techniques, planning, team building, motivation, ethics, decision-making, and managing change. Relies heavily on interactive experiential classes with case studies, student presentations, role plays, and discussion. Also appropriate for non-management science majors.  
Staff

NS.402 Leadership and Ethics  
Prereq: First class cruise/NS.401  
U (Spring)  
3-0-3  
Analyzes ethical decision-making and leadership principles. Students read and discuss texts written by such philosophers as Aristotle, Kant and Mill to gain familiarity with the realm of ethical theory. Students then move on to case studies in which they apply these theories to resolve moral dilemmas. Provides a basic background in the duties and responsibilities of a junior division and watch officer; strong emphasis on the junior officer’s responsibilities in training, counseling, and career development. Student familiarization with equal opportunity and drug/alcohol rehabilitation programs. Principles of leadership reinforced through leadership case studies.  
Staff

NS.410 Evolution of Expeditionary Doctrine  
Prereq: —  
U (Spring)  
2-0-4  
Historical and tactical analysis of expeditionary doctrine, from its roots in amphibious warfare to current actions and future developments. Seeks to define the concept, explore its doctrinal origins, and trace its evolution as an element of naval policy throughout and beyond the 20th century. Case study approach used to provide the prospective Marine Corps officer with the fundamentals of expeditionary maneuver warfare on doctrinal, strategic, operational, tactical and technological levels.  
Staff
Interphase
Seminar XL
Experimental Study Group
Concourse Program
Terrascope
Women’s and Gender Studies Program
Edgerton Center
Freshman/Alumni Summer Internship Program

INTERPHASE:
PRE-FRESHMAN SUMMER PROGRAM

SP.100 Interphase
Prereq: Commitment to register as a freshman in the fall
Units arranged
A seven-week academic skills-honing program, Interphase is designed to enhance the preparedness of students entering MIT in the fall term. The program has a dual focus: academic readiness and general educational development. The program involves calculus, chemistry, physical education, physics, writing, and supporting academic activities, including small-group learning. The students can earn transcript credit for subjects taken in the program, sometimes resulting in advanced placement in corresponding subjects taken in the fall. Activities include day trips to area cultural, recreational, and business sites. Students participate in a range of personal and educational development seminars and activities designed to ensure their smooth transition to college life. The summer experience gives them increased opportunity to prepare for the rigors of an MIT full-subject load.

K. W. Reid

SEMINAR XL

SEM.XL1 Program XL: You Can Be a Success at MIT
Prereq: First-year undergraduate standing
Units arranged [P/D/F]

SEM.XL2 Program XL: You Can Be a Success at MIT
Prereq: First-year undergraduate standing
Units arranged [P/D/F]

An academic enrichment program for first-year students, XL utilizes the innovative and effective small-group learning concept to enhance students’ academic performance in calculus and science. Students meet in study groups of five to six participants with facilitators trained in effective classroom techniques and concept focus. The study groups help students to reinforce concepts learned in the regular curriculum, and help them to gain mastery of concepts and problems that are often more challenging than those dealt with during lecture. The small study group format emphasizes the full participation of each student with the facilitator acting as a guide. The regularity of weekly meetings enhances the students’ understanding of MIT’s academic expectations. After the initial meetings, students are encouraged to take more responsibility and to lead the group in problem-solving sessions, which helps to maximize their own learning. Each study group meets for a minimum of three hours each week. The meeting time is set by the XL facilitator based on students’ schedules. S. Mtingwa

EXPERIMENTAL STUDY GROUP

SP.211 ESG (Experimental Study Group)
Prereq: —
Units arranged [P/D/F]

SP.212 ESG (Experimental Study Group)
Prereq: —
Units arranged [P/D/F]

An innovative and personalized program for first-year students who wish to take a more active role in their MIT education. In place of lectures and large classes, ESG students take their core subjects through small interactive classes, seminars, and independent study projects, with opportunity for more flexibility in pace and scheduling than is normally available in the regular curriculum. Credit is available in freshman subjects in biology, chemistry, computer science, mathematics, and physics, as well as several HASS, HASS-D, and CI-H offerings. Certain sophomore-level subjects can be studied in ESG, depending on staff and student interest. Undergraduate seminars in a variety of areas are also offered, including psychology, music, robotics, and creative writing. Students are expected to take the majority of their classes in ESG but may take one or two classes in the regular curriculum. Staff includes MIT faculty, lecturers, graduate students, and undergraduate instructors who are interested in teaching in a small and informal academic community. A. Slocum

SP.221 ESG (Experimental Study Group)
Prereq: SP.211 and/or SP.212
Units arranged [P/D/F]

SP.222 ESG (Experimental Study Group)
Prereq: SP.211 and/or SP.212
Units arranged [P/D/F]

Continuation of ESG for sophomores. A. Slocum

SP.231 ESG Undergraduate Teaching
Prereq: SP.211 and/or SP.212
Units arranged [P/D/F]

SP.232 ESG Undergraduate Teaching
Prereq: SP.211 and/or SP.212
Units arranged [P/D/F]

An opportunity to assist in the teaching of subjects in ESG in biology, chemistry, computer science, humanities and social sciences, mathematics, and physics. Student instructors may be involved in grading, running problem solving sessions, or teaching classes depending on experience and interest. Qualified students may also develop and teach undergraduate seminars under the close supervision of an appropriate
faculty or staff member. Student instructors meet weekly with staff to discuss their teaching and cover a variety of topics related to effective teaching techniques.
A. Slocum

SP.233 ESG Special Topics
Prereq: —
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

Independent study projects which are not covered in the regular ESG offerings. These projects require prior approval and regular supervision by a staff member, as well as a written proposal and a final report.
A. Slocum

SP.2H1 ESG-Humanities Elective
Prereq: —
U (Fall, Spring)
3-0-9 HASS
Can be repeated for credit
Instructor TBD

SP.2H3 Ancient Philosophy and Mathematics
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 2, CI-H

Explores the relationship between ancient Greek philosophy and mathematics. Investigates how ideas of definition, reason, argument and proof, rationality/irrationality, number, quality and quantity, truth, and even the idea of an idea were shaped by the interplay of philosophic and mathematical inquiry. Examines how discovery of the incommensurability of magnitudes challenged the Greek presumption that the kosmos is fully understandable. Explores the influence of mathematics on ancient Greek ethical theories. Authors: Euclid, Plato, Aristotle, Nicomachus, Theon of Smyrna, Bacon, Descartes, Dedekind, and Newton. Priority given to students in the Experimental Study Group.
L. Perlman

SP.2UR Undergraduate Research in ESG
Prereq: —
U (Fall, IAP, Summer)
Units arranged [P/D/F]
Can be repeated for credit

For students wishing to pursue undergraduate research opportunities in the Experimental Study Group.
A. Slocum

CONCOURSE PROGRAM

SP.311 Concourse Program
Prereq: —
U (Fall)
Units arranged [P/D/F]

An integrative program for the freshman year. Staff includes faculty from the Schools of Science, Engineering, and Humanities and Social Science. Credits in Concourse fulfill the General Institute Requirements and are so recorded.
R. M. Rose

SP.312 Concourse Program
Prereq: —
U (Spring)
Units arranged [P/D/F]

For students wishing to pursue additional humanities or writing subjects in Concourse beyond freshman year. Subject matter changes from year to year.
Staff

SP.313 Concourse Program for Upperclassmen
Prereq: Permission of instructor
U (Spring)
Units arranged [P/D/F]
Can be repeated for credit

For students wishing to pursue additional humanities or writing subjects in Concourse beyond freshman year. Subject matter changes from year to year.
Staff

SP.314 Love and Aggression
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS-D, Category 1, CI-H

Subject explores the interrelated topics of love and aggression from the vantage points of literature and psychology. Students read a series of texts from Biblical excerpts to the modern novel. Lectures, classroom discussions, and writing assignments consider whether the text deliberately or unintentionally borrows from psychological theory. Enrollment limited and restricted to students enrolled in Concourse.
J. Wolfe, W. Kelley

SP.315 Concourse Program Undergraduate Teaching
Prereq: SP.311 or SP.312; permission of instructor
U (Fall)
Units arranged
Can be repeated for credit

SP.316 Concourse Program Undergraduate Teaching
Prereq: SP.311 or SP.312; permission of instructor
U (Spring)
Units arranged
Can be repeated for credit

Tutoring, leadership of study and review groups, seminars and recitations in the Concourse Program, under the supervision of senior Concourse staff.
Staff

SP.317 Memory and Literature
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS-D, Category 1, CI-H

There are many forms of memory. Memories can be explicit or implicit, hidden from conscious awareness. They can be long lasting or fleeting, individual or held by a group. Examines this diversity of memory through works of literature. Specific topics include the nature of historical memory: how it changes over time and place, the connection between memory and art, and repressed or hidden memories. Illustrated with readings from psychological sources as well as ancient and modern literature. Group and individual oral presentations. Restricted to students enrolled in Concourse. Limited enrollment.
J. Wolfe

SP.321 Madness and Literature
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS-D, Category 1, CI-H

Examines “madness” (or, more technically, abnormal behavior) through the lens of literature; how literature reveals changes in the conceptions of madness over time and how literature can offer a glimpse of the first-person experience of madness. Considers the long-standing, folk-psychological theory that there is a link between art and madness. Enrollment limited and restricted to students enrolled in Concourse.
J. Wolfe
SP.322 Prohibition and Permission
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS-D, Category 1, CI-H

Explore where the prohibitions and permissions that occur in every day life come from, why they exist, and what gives them force. For example: food—you are only willing and able to eat a subset of the world’s edible substances. Marriage—some marriages are prohibited by law or by custom. Addresses questions of prohibition and permission using psychological sources and literary works from ancient to modern. Includes texts by Shakespeare, Melville, Mary Rowlandson, and Anita Desai. Students give group and individual oral presentations. Enrollment is restricted to Concourse students and limited to 18 students per section.
J. Wolfe, W. Kelley

SP.330 Psychology and Free Will (New)
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 4, CI-H

Examines the question of human freedom and its role in fields from philosophy and religion to politics and law. Explores whether a behavior is a matter of choice or is predetermined. Examines why people do evil things, why they perform noble acts, and why they perform voluntary acts, such as moving a leg or reading this subject description. Studies human behavior and human mental life through the lens of psychology. Asks whether the facts and theories of modern psychology leave room for human freedom. Enrollment limited and restricted to students enrolled in Concourse.
J. Wolfe

SP.343 Concourse Special Topics
Prereq: Permission of instructor
U (Fall)
Units arranged [P/D/F]
Can be repeated for credit

SP.344 Concourse Special Topics
Prereq: Permission of instructor
U (Spring)
Units arranged [P/D/F]
Can be repeated for credit

Open to students enrolled in Concourse who wish to pursue topics not covered in the regular Concourse offerings. Topics change from year to year.
R. M. Rose

SP.345, SP.346, SP.347 Concourse Special Topics for IAP
Prereq: Permission of instructor
U (IAP)
Units arranged [P/D/F]
Can be repeated for credit

Open to students who wish to pursue topics over IAP not covered in the regular Concourse offerings. Topics change from year to year.
R. M. Rose

SP.3UR Undergraduate Research Opportunities in Concourse
Prereq: SP.311 or SP.312
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit

For students wishing to pursue undergraduate research opportunities in Concourse.
R. M. Rose

TERRASCOPE

SP.35UR Undergraduate Research in Terrascope
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
Staff

SP.360 Terrascope Radio
Prereq: 1.016
U (Spring)
3-3-6 HASS, CI-H

An exploration of radio as a medium of expression and communication, particularly the communication of complex scientific or technical information to general audiences. Examines the ingredients of effective radio programming, drawing extensively on examples from both commercial and public radio. Student teams produce, assemble, narrate, record and broadcast/webcast radio programs on topics related to the complex environmental issue that is the focus of the year’s Terrascope subjects. Includes multiple individual writing assignments that explore the constraints and opportunities in radio as a medium. Limited to 12 Terrascope students only.
A. W. Epstein, R. L. Bras, H. Jenkins

WOMEN’S AND GENDER STUDIES PROGRAM

SP.400 Special Topics in Women’s Studies
Seminar
Prereq: —
U (Fall, Spring)
3-0-9 HASS
Can be repeated for credit

Seminar with one-time topics not taught within regular offerings.
Fall: H. Paxson
Spring: A. Castillo

SP.401 Introduction to Women’s and Gender Studies
Prereq: —
U (Fall, Spring)
3-0-9 HASS-D, Category 4, CI-H

Drawing on multiple disciplines—such as literature, history, economics, psychology, philosophy, political science, anthropology, media studies and the arts—to examine cultural assumptions about sex, gender, and sexuality. Integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the ways sex and gender interact with race, class, nationality, and other social identities. Students are introduced to recent scholarship on gender and its implications for traditional disciplines.
Staff

SP.404 Special Topics in Women’s Studies
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit

SP.405 Special Topics in Women’s Studies
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged
Can be repeated for credit

Individual supervised work for graduate students who wish to study topics not covered in the regular Women’s and Gender Studies offerings. Before registering for this subject, students must plan a course of study with a member of the Women’s and Gender Studies faculty and secure the director’s approval. Normal maximum is 6 units; exceptional 9-unit projects occasionally approved.
Staff
SP.406 Sexual and Gender Identities
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Introduces scholarly debates about sexual identities, gender identities and expressions, and sexual orientation and its representation in various media. Topics may include lesbian, gay, bisexual, and transgender (LGBT) sexual identities as well as their histories in Western and non-Western cultures; queer theory and theories of identity; the origins of social movements for equality; issues of race and diversity within LGBT communities; questions of visibility and media representation; and the politics of sexual orientation in contemporary American institutions. Materials include secondary readings in history, philosophy and cultural theory as well as novels and plays, films and television programs, community studies, oral histories, and legal cases.
K. Surkan

SP.409 Women and Global Activism in Media and Politics
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 4, CI-H
An interdisciplinary subject that examines questions of feminism, international women’s issues, and globalization through the study of novels, films, critical essays, painting and music. Considers how women redefine the notions of community and nation, how development affects their lives, and how access to the internet and to the production industry impacts women’s lives. Primary topics of interest include transformations of traditional values, social change, gender role distribution, identity formation, migration flows, globalization and development, popular culture, urban life, cyber-culture, activism, and human rights. Enrollment limited to 25 when Writing Tutor is assigned to the class. Otherwise, 18.
A. Sur

SP.410 Masculinity in Popular Culture (New)
(Same subject as 21A.233J)
Prereq: —
U (Fall)
3-0-9 HASS
See description under subject 21A.233J.
D. Goodman

SP.414 Gender and Media Studies (New)
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS
Examines representations of race, gender, and sexual identity in the media. Considers issues of authorship, spectatorship, and the ways in which various media (film, television, print journalism, advertising) enable, facilitate, and challenge these social constructions in society. Studies the impact of new media and digital media through analysis of gendered and racialized language and embodiment online in blogs and vlogs, avatars, and in the construction of cyber-identities. Provides introduction to feminist approaches to media studies by drawing from work in feminist film theory, cultural studies, gender and politics, and cyberfeminism.
K. Surkan

SP.450 The Harem and the Veil: Images and Representations of Gender in the Middle East
(Same subject as 21A.458J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS, CI-H
See description under subject 21A.458J.
Staff

SP.454 Identity and Difference
(Same subject as 21A.218J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
See description under subject 21A.218J.
J. Jackson

SP.455 Gender, Sexuality, and Society
(Same subject as 21A.301J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
See description under subject 21A.301J.
H. Paxson

SP.457 Gender, Power, and International Development
(Same subject as 21A.338J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
See description under subject 21A.338J.
C. Walley

SP.459 Women in South Asia from 1800 to Present
(Same subject as 21H.575J)
Prereq: —
U (Fall)
3-0-9 HASS
See description under subject 21H.575J.
H. Roy

SP.461 International Women’s Voices
(Same subject as 21F.022J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 1, CI-H
See description under subject 21F.022J.
I. de Courtivron

SP.466 Topics in Modern French Literature
(Subject meets with 21F.346)
Prereq: One intermediate subject in French
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Can be repeated for credit
Meets with 21F.346 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects.
I. de Courtivron

SP.484 The Anthropology of Computing
(Same subject as 21A.350J, STS.086J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
See description under subject 21A.350J.
S. Helmreich

SP.492 Popular Narrative
(Subject meets with 21L.430, CMS.920)
Prereq: One subject in Literature
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-3-6 HASS
Can be repeated for credit
Meets with 21L.430 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects.
Staff
SP.493 Media in Cultural Context  
(Subject meets with 21L.715, CMS.871)  
Prereq: Two subjects in Literature and/or Comparative Media Studies or permission of instructor  
U (Fall)  
3-3-6 HASS  
Can be repeated for credit  

Meets with 21L.715 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects. Provides close case study examinations of specific media or media configurations and the larger social, cultural, economic, political, or technological contexts within which they operate. Topics organized around recurring themes in media history, specific genres or movements, specific media, or specific historical moments. Previously taught cross-listed topics include Gendered Genres: Horror and Maternal Melodramas, Girl Culture in Japan, and Exploring Children’s Culture.  
S. Brouillette

SP.510 Literary Interpretation  
(Subject meets with 21L.701)  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall, Spring)  
3-0-9 HASS  
Can be repeated for credit  

Meets with 21L.701 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects, such as Virginia Woolf’s Shakespeare.  
Staff

SP.511 Studies in Poetry  
Prereq: Two subjects in Literature  
U (Spring)  
3-0-9 HASS  
Can be repeated for credit  

Meets with 21L.704 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects such as Gender and Lyric in the English Renaissance, and Poetry in the Age of Elizabeth I.  
Staff

SP.512 Major Authors  
(Subject meets with 21L.705)  
Prereq: Two subjects in Literature  
U (Fall)  
3-0-9 HASS  
Can be repeated for credit  

Meets with 21L.705 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects such as Willa Cather, and Morrison and Melville.  
Staff

SP.513 Jane Austen  
(Same subject as 21L.473)  
Prereq: One subject in Literature  
U (Fall)  
3-0-9 HASS  
See description under subject 21L.473.  
R. Perry

SP.514 Medieval Literature  
(Subject meets with 21L.460)  
Prereq: —  
U (Fall)  
3-0-9 HASS  
Meets with 21L.460 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects such as Medieval Women’s Literature.  
Staff

SP.515 Studies in Fiction  
Prereq: Two subjects in Literature  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9 HASS  
Can be repeated for credit  

Meets with 21L.702 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects.  
Staff

SP.516 Problems in Cultural Interpretation  
Prereq: Two subjects in Literature or permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9 HASS  
Can be repeated for credit  

Meets with 21L.707 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects such as Gender and Ideology in 18th-century Literature; Technobodies; and Women Reading, Women Writing.  
See description under subject 21L.707.  
Staff

SP.517 American Authors  
(Subject meets with 21L.512)  
Prereq: One subject in Literature  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
3-0-9 HASS  
Meets with 21L.512 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects such as American Women Writers. See 21L.512 for topic description.  
A. Braithwaite

SP.518 Race and Identity in American Literature  
(New)  
(Same subject as 21L.504)  
Prereq: —  
U (Fall)  
3-0-9 HASS  
See description under subject 21L.504.  
S. Alexandre

SP.574 Contemporary US Women of Color: Writing and Reading Short Stories  
(Same subject as 21W.766)  
Prereq: —  
U (Spring)  
3-0-9 HASS  
See description under subject 21W.766.  
H. Lee

SP.575 Writing About Race  
(Same subject as 21W.742)  
Prereq: —  
U (Spring)  
3-0-9 HASS-D, Category 2, CI-H  
See description under subject 21W.742.  
S. King

SP.576 Advanced Essay Workshop  
(Subject meets with 21W.745)  
Prereq: —  
Acad Year 2007–2008: U (Fall)  
Acad Year 2008–2009: Not offered  
3-0-9 HASS, CI-H  
Meets with 21W.745 when the topic has content consistent with the requirements for Women’s and Gender Studies subjects such as Negotiating Identities and Writing about Gender.  
Staff
SP.591J Traditions in American Concert Dance: Gender and Autobiography
(Same subject as 21M.670J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 3, CI-H
See description under subject 21M.670J.
T. DeFrantz

SP.595J Theater and Cultural Diversity in the US (New)
(Same subject as 21M.621J)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 3
See description under subject 21M.621J.
T. DeFrantz

SP.601J Feminist Political Thought
(Same subject as 17.007J)
Subject meets with 17.006, 24.237
Prereq: —
U (Spring)
3-0-9 HASS
Analyzes theories of gender and politics, especially ideologies of gender and their construction; definitions of public and private spheres; gender issues in citizenship, the development of the welfare state, experiences of war and revolution, class formation, and the politics of sexualities. Graduate students are expected to pursue the subject in greater depth through reading and individual research.
E. Wood

SP.607J Gender and the Law in US History
(Same subject as 21H.225J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
See description under subject 21H.225J.
C. Capozzola

SP.608J Cultural Performances of Asia
(Same subject as 21F.067J)
Subject meets with 21F.595J
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
See description under subject 21F.067J.
I. Condry

SP.610J The Economic History of Work and Family
(Same subject as 21H.927J)
Subject meets with SP.680J
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
2-0-7 HASS
See description under subject 21H.927J.
A. McCants

SP.620J Medicine, Religion and Politics in Africa and the African Diaspora
(Same subject as 21A.460J)
Prereq: —
U (Spring)
3-0-9 HASS
See description under subject 21A.460J.
E. C. James

SP.621J Violence, Human Rights, and Justice
(Same subject as 21A.225J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS, CI-H
See description under subject 21A.225J.
E. C. James

SP.622J Dilemmas in Biomedical Ethics: Playing God or Doing Good?
(Same subject as 21A.216J)
Prereq: —
U (Spring)
3-0-9 HASS, CI-H
See description under subject 21A.216J.
E. C. James

SP.640J The Science of Race, Sex, and Gender
(Same subject as STS.046J)
Prereq: —
U (Fall)
3-0-9 HASS, CI-H
Examines the role of science and medicine in the origins and evolution of the concepts of race, sex, and gender from the seventeenth century to the present. Focus on how biological, anthropological, and medical concepts intersect with social, cultural, and political ideas about racial, sexual, and gender difference in the US and globally. Approach is historical and comparative across disciplines emphasizing the different modes of explanation and use of evidence in each field.
A. Sur

SP.650J Psychology of Gender and Race
(Same subject as 9.75J)
Prereq: —
U (Fall, Spring)
3-0-9 HASS
See description under subject 9.75J.
C. Kapungu

SP.680 The Economic History of Work and the Family
(Same subject with SP.610J, 21H.927J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9
Explores the changing map of the public and the private in pre-industrial and modern societies and examines how that map affected men's and women's production and consumption of goods and leisure. The reproductive strategies of women, either in conjunction with or in opposition to their families, is another major theme. Subject asks how an ideal of the "domestic" arose in the early modern west, and to what extent did it limit the economic position of women; and how has that idea been challenged, and with what success in the post-industrial period. Focuses on western Europe since the Middle Ages and on the US, but also examines how these issues have played themselves out in non-Western cultures. Students taking the graduate version are expected to pursue the subject in greater depth through reading and individual research.
A. McCants

SP.690 Workshop for Dissertation Writers in Women’s and Gender Studies
Prereq: Must apply to the Graduate Consortium in Women’s Studies
G (Fall, Spring)
3-0-9
Can be repeated for credit
Addresses the main challenges faced by dissertation writers: isolation, writing schedules, and cogent arguments. Opportunity for members to exchange ideas and experiences, learn general principles of academic argument, and receive feedback. Open to graduate students in all phases of dissertation writing. Meets bi-weekly, spans fall and spring terms. Enrollment limited to 10.
Consult Graduate Consortium in Women’s Studies
SP.691 Studies in Women's Life Narratives
Prereq: Must apply to the Graduate Consortium in Women's Studies
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Information: Graduate Consortium in Women's Studies

SP.692 Seminar in Feminist Issues
Prereq: Must apply to the Graduate Consortium in Women's Studies
G (Fall)
3-0-9
Can be repeated for credit
Syllabi vary depending on instructors. Fall 2007 Topic: Representing Gender: Global Perspectives on Art, Media and Popular Culture. Enrollment limited to 10.
Information: Graduate Consortium in Women's Studies

SP.693 Feminist Inquiry: Strategies for Effective Scholarship
Prereq: Must apply to the Graduate Consortium in Women's Studies
G (Fall)
3-0-9
Can be repeated for credit
Investigates theories and practices of feminist inquiry across a range of disciplines. Feminist research involves rethinking disciplinary assumptions and methodologies, developing new understandings of what counts as knowledge, seeking alternative ways of understanding the origins of problems/issues, formulating new ways of asking questions and redefining the relationship between subjects and objects of study. Focus on methodology, i.e., the theory and analysis of how research should proceed. Special attention to epistemological issues—pre-suppositions about the nature of knowledge. What makes research distinctively feminist lies in the complex connections between epistemologies, methodologies and research methods. Explore how these connections are formed in the traditional disciplines and raise questions about why they are inadequate and/or problematic for feminist inquiry and what, specifically, are the feminist critiques of these intersections.
Information: Graduate Program in Women's Studies

SP.694 Issues of Representation: Feminist Theory
Prereq: Application to the Graduate Consortium in Women's Studies
G (Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit
Consult Graduate Program in Women's Studies

SP.695 Interdisciplinary Area Studies in Feminist Theories
Prereq: Must apply to the Graduate Consortium in Women's Studies
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9
Can be repeated for credit
Syllabi vary depending on instructors.
Information: Graduate Consortium in Women's Studies

SP.4UR Women's and Gender Studies Undergraduate Research
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
SP.4URG Women's and Gender Studies Undergraduate Research
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit
Undergraduate Research opportunities in the Women's and Gender Studies Program.
Staff

EDGERTON CENTER

For a full listing of classes offered by the Edgerton Center, as well as class descriptions, please go to the Edgerton Center Course website. (http://web.mit.edu/Edgerton/www/Courses.html)

SP.702J Introduction to Digital Electronics
(Same subject as 6.072J)
Prereq: —
U (Fall, IAP, Spring)
0-3-3 [P/D/F]
Design your own circuits for times when off-the-shelf solutions are not available. Seminar begins with assembly of a utility board. Weekly labs cover digital logic gates, memory elements, and finite-state machine design. Seminar concludes with a team-based design project. Preference given to freshmen. Maximum of 10 students per term, lottery at the first class session if oversubscribed.
J. Bales

SP.705J Electronics Project Laboratory
(Same subject as 6.070J)
Prereq: —
U (Fall, IAP, Spring)
2-2-2
See description under subject 6.070J.
E. J. Moriarty

SP.710–SP.715 Special Topics at the Edgerton Center
Prereq: —
U (Fall, IAP, Spring)
Units arranged [P/D/F]
Can be repeated for credit
SP.716–SP.720 Special Topics at the Edgerton Center
Prereq: —
U (Fall, IAP, Spring)
Units arranged
Can be repeated for credit
Seminars combining lectures and lab run by students and academic staff at the Edgerton Center. Students explore specialized electronics, robotics, or mechanical design and fabrication topics from beginner level to more advanced. Some offerings may be taught in an intensive fashion (meeting for up to several times a week for four weeks). Up to three sequential seminars may be offered per semester, covering a different topic each time. Students can take one or all of the seminars.
J. K. Vanderweele

SP.721J D-Lab: Development
(Same subject as 11.025J)
(Same subject as 11.472)
Prereq: Permission of instructor
U (Fall)
3-2-7
Issues in international development, appropriate technology and project implementation addressed through lectures, case studies, guest speakers and laboratory exercises. Students form project teams to partner with community organizations in developing countries, and formulate plans for an IAP site visit. (Previous field sites include Haiti, Brazil, Honduras and India.) Recitation sections focus on specific project implementation, and include cultural, social, political, environmental and economic overviews of the target countries as well as an introduction to the local languages.
A. B. Smith, B. Sanyal
SP.722] D-Lab: Design
(Same subject as 2.722)
Prereq: 2.670 or permission of instructor
U (Spring)
3-0-9
Addresses problems faced by underserved communities with a focus on design, experimentation, and prototyping processes. Particular attention placed on constraints faced when designing for developing countries. Multidisciplinary teams work on long-term projects in collaboration with community partners, field practitioners, and experts in relevant fields. Topics covered include design for affordability, manufacture, sustainability, and strategies for working effectively with community partners and customers. Students may continue projects begun in SP.721.
A. B. Smith, J. K. Vandiver, D. R. Wallace

SP.723 D-Lab: Dissemination - Implementing Innovations for the Common Good
Prereq: —
U (Spring)
3-0-6
Focuses on Third World development using case studies and team collaboration. Students draw lessons from success stories and identify challenges, unintended consequences and failures in implementing technologies, projects and policies. Students acquire skills in the building of partnerships and learn how to pilot, implement, and scale-up a selected innovation for the common good. Teams develop an idea, project or business plan that is ready to roll by semester's end. Limited to 30 students.
S. E. Murcott

SP.724 Prototype to Product
Prereq: Permission of instructor
U (Fall)
1-2-3
Can be repeated for credit
Students and teams who have started a project in D-Lab, the IDEAS Competition, Design for Demining, Product Engineering Processes or elsewhere can continue developing projects to be implemented in the field. Topics covered include prototyping techniques, materials selection, design-for-manufacturing, field-testing, and project management. All coursework directly relates to student projects. Students should have an existing project that they wish to advance to the next level. Teams are encouraged to enroll together. Enrollment limited to 15. No listeners.
A. Heafitz

SP.731 Edgerton Center Undergraduate Teaching
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
An opportunity for undergraduates to participate in teaching and tutoring Center subjects and seminars. Students develop one-on-one teaching skills under the supervision of an Edgerton Center instructor.
J. K. Vandiver

SP.732 Edgerton Center Graduate Teaching
Prereq: —
G (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit
An opportunity for graduate students to participate in teaching and tutoring Edgerton Center subjects and seminars. Permission of Edgerton Center staff required.

SP.747 Creative Imaging
Prereq: —
U (Spring)
2-1-6
Credit cannot also be received for SP.757
Subject centered around both film and digital photography. Students use chemical darkrooms, scanners, digital printers and cameras, and video capture equipment. Software used includes Adobe Photoshop, Illustrator and Premiere. Subject deals with photography with emphasis on the interplay between classical chemical and digital techniques. Each student is expected to develop a creative imaging term project of their own choice. Intermediate goals are set.
J. Bales

SP.757 Digital and Darkroom Imaging
Prereq: —
U (Fall)
2-0-4 [P/D/F]
Credit cannot also be received for SP.747
Edgerton Center Seminar. Each student will learn to use both film and digital photography in developing a creative imaging project of his or her own choice. The New Media Center 26-139 will be used to develop facility in applying Photoshop 7.0 to enhance, select and combine images that the student has taken for the project. The darkrooms of the Edgerton Center will be used to develop film for scanning and for chemical enlargement. The digital imaging facilities of the Center include scanners, Macintosh workstations, digital cameras and digital printers. Review of student work will be interspersed with chalk talks and slide and print demonstrations on topics such as aliasing, modes and formats, image compression, and halftone and dye sublimation printing. Each student will be expected to produce a duplicate set of black and white and/or color prints as the project output: one to keep and one for display at the Center.
T. Mislick

SP.764 Practical Electronics
(Subject meets with SP.765)
Prereq: —
U (Fall, Spring)
1-3-2
Credit cannot also be received for SP.765
Students will gain an intuitive understanding of simple, practical circuits. By building and testing circuits, and observing how their performance can be tailored by changing the values of select components. Students become familiar with the standard items of test equipment. Topics include passive components, transistor switches, comparators, operational amplifiers, and elementary timing circuits, and sensors and actuators. Concludes with a design project applying the material learned.
J. Bales

SP.766 Practical Electronics
(Subject meets with SP.764)
Prereq: —
G (Fall, Spring)
1-3-2
Credit cannot also be received for SP.764
See description under subject SP.764.
J. Bales

SP.771 Electronic Musical Instruments
Prereq: —
U (Spring)
2-2-2 [P/D/F]
Product development in the context of creating electronic musical instruments for developmentally disabled students in the local community. Introduction to acoustics and design as well as practical electronics, mechanical design, and prototyping. Focus on identifying user needs and working in teams to deliver robust instruments.
S. Bonzaert

SP.776 Design for Demining
(Subject meets with SP.786)
Prereq: —
U (Spring)
2-1-6
Students learn about humanitarian demining as a response to land mines left over from old conflicts that maim or kill civilians. Students design
and build a device to aid the demining community. Field trips and guest speakers enhance the study of demining. Topics include the expense, time, and danger involved in removing mines as well as the impact to the citizens and economy if the mines are not removed.

A. Heafitz, B. Linder

SP.778 Toy Product Development (New)
Prereq: Machine shop and CAD modeling experience beneficial
U (Spring)
3-3-3

Design and prototype new children’s toys and learn the basics of design for entertainment. Work closely with a local sponsor, experienced mentors, and a local elementary school on a themed toy design project. Gain experience with the product development process including determining customer needs, benchmarking, brainstorming, concept development, prototyping, and design. Basics of patents and manufacturing. Enrollment limited to 30.

D. Wallace, B. Kudrowitz

SP.783 Engineering Capacity in Community-Based Healthcare
Prereq: Permission of instructor
G (Fall)
2-0-4 [P/D/F]

Fundamental issues in global health faced by community-based healthcare programs in developing countries. Explore topics with expert lecturers and guided readings. Topics are further illuminated with case studies from healthcare programs in the developing world. Multidisciplinary teams are formed to develop feasible solutions to specific health challenges posed in the case studies. Possible topics include community-based AIDS/HIV management, maternity care, health diagnostics, and information technology in patient management and tracking. Enrollment limited to 12.

W. DelHagen

SP.786 Design for Demining
(Subject meets with SP.776)
Prereq: —
G (Spring)
2-1-6

See description under subject SP.766.
A. Heafitz, B. Linder

SP.7UR Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit

SP.7URG Undergraduate Research–Graded
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Undergraduate research opportunities in the Edgerton Center.
J. K. Vandiver

FRESHMAN/ALUMNI SUMMER INTERNSHIP PROGRAM

SP.800 Freshman/Alumni Summer Internship Program
Prereq: —
U (Spring)
Units arranged

Prepares freshmen for summer internships in various companies. Includes workshops on leadership skill development, interviewing, communications, negotiation, and dynamics in the workplace. Upon acceptance to the program, students have readings, writings, discussion, and role-playing exercises. Attendance at the workshops is mandatory.
A. Steinberg

SP.801 Freshman/Alumni Summer Internship Program II
Prereq: SP.800
U (Fall)
Units arranged

Students who have completed the subject requirements for SP.800 and worked in an approved internship polish their communication skills further by writing reflection papers and giving a formal presentation about their experiences upon their return in the fall.
A. Steinberg
GENERAL UNDERGRADUATE SUBJECTS

STS.001 Technology in American History
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5, CI-H

A survey of America’s transition from a rural, agrarian, and artisan society to one of the world’s leading industrial powers. Treats the emergence of industrial capitalism: the rise of the factory system; new forms of power, transport, and communication; the advent of the large industrial corporation; the social relations of production; and the hallmarks of science-based industry. Views technology as part of the larger culture and reveals innovation as a process consisting of a range of possibilities that are chosen or rejected according to the social criteria of the time.
M. R. Smith

STS.002 Toward the Scientific Revolution
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5, CI-H

Traces the evolution of Western ideas about nature, and the best way to study and explain natural phenomena, from ancient times through the Renaissance. Examines scientific concepts in their historical and cultural contexts, ranging from natural history to physics, mathematics, and medicine.

Staff

STS.003 The Rise of Modern Science
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 5

The development of major fields in the physical and life sciences, beginning with 18th-century Europe and ending with 20th-century America. Examines ideas, institutions, and the social settings of the sciences, with emphasis on how cultural contexts influence scientific concepts and practices.
S. Gerovitch

STS.005 Disease and Society in America
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 5, CI-H

Examines the growing importance of medicine in culture, economics and politics. Uses a historical approach to examine changing patterns of disease, the causes of morbidity and mortality, evolution of medical theory and practice, development of hospitals and the medical profession, the rise of the biomedical research industry, and the ethics of health care in America.
D. Jones

STS.006j Bioethics
(Same subject as 24.06j)
Prereq: —
U (Spring)
3-0-9 HASS-D, Category 2, CI-H

See description under subject 24.06j.
C. Hare, D. Jones

STS.011 American Science: Ethical Conflicts and Political Choices
Prereq: —
U (Fall)
3-0-9 HASS-D, Category 2

Explores the changing roles, ethical conflicts, and public perceptions of science and scientists in American society from World War II to the present. Studies specific historical episodes focusing on debates between scientists and the contextual factors influencing their opinions and decisions. Topics include the atomic bomb project, environmental controversies, the Challenger disaster, biomedical research, genetic engineering, (mis)use of human subjects, scientific misconduct and whistleblowing.

Staff

STS.014j Principles and Practice of Science Communication
(Same subject as 21W.782j)
Prereq: —
U (Spring)
3-0-9 HASS

Develop skills as science communicators through projects and analysis of theoretical principles. Case studies explore the emergence of popular science communication over the past two centuries and the changing relationships among authors, audiences and media. Project topics are identified early in the term, and feature opportunities to work with the MIT Museum staff or participate in a citywide Cambridge Science Festival. Projects may involve physical exhibits, practical demonstrations, or scripts for public programs.
J. Durant

STS.015 Mapping Controversies: Preparing Scientists and Engineers for a More Complex World (New)
Prereq: —
U (Spring)
3-0-9 HASS

Introduction to the complicated universe of scientific and technical research. Account for and map techno-scientific controversies which are rife with uncertainties and dilemmas. Controversies studied include projects of advanced technical expertise as well as projects entangled with legal, moral, economic and social questions. Learn how to describe these contentious arenas and present findings by creating websites available to the general public. Some sites may be selected to participate in an international student competition. Enrollment limited to 25.
V. Lepinay

ADVANCED UNDERGRADUATE SUBJECTS

STS.029j The Civil War and Reconstruction
(Subject meets with STS.423)
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS

See description under subject 21H.116j.
M. R. Smith
ST.036 Technology and Nature in American History  
Prereq: —  
U (Spring)  
3-0-9 HASS, CI-H  
Considers how the visual and material world of "nature" has been reshaped by industrial practices, ideologies, and institutions, particularly in 19th- and 20th-century America. Topics include land-use patterns; the changing shape of cities and farms; the redesign of water systems; the construction of roads, dams, bridges, irrigation systems; the creation of national parks; ideas about wilderness; and the role of nature in an industrial world.  
J. Pietruska

ST.038 Energy and Environment in American History  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
3-0-9 HASS  
A survey of how America has become the world's largest consumer of energy. Explores American history from the perspective of energy and its relationship to politics, diplomacy, the economy, science and technology, labor, culture, and the environment. Topics include muscle and water power in early America, coal and the Industrial Revolution, electrification, energy consumption in the home, oil and US foreign policy, automobiles and suburbanization, nuclear power, OPEC and the 1970s' energy crisis, global warming, and possible paths for the future.  
Staff

ST.042] Einstein, Oppenheimer, Feynman: Physics in the 20th Century  
(Same subject as 8.225J)  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
3-0-9 HASS  
Explores the changing roles of physics and physicists during the 20th century. Topics range from relativity theory and quantum mechanics to high-energy physics and cosmology. Examines the development of modern physics within shifting institutional, cultural, and political contexts, such as physics in Imperial Britain, Nazi Germany, US efforts during World War II, and physicists' roles during the Cold War. Enrollment limited.  
D. I. Kaiser

ST.043 Technology and Self: Science, Technology, and Memoir  
(Subject meets with STS.443)  
Prereq: Writing sample  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Fall)  
2-0-7 HASS  
Focuses on the memoir as a window onto the relationship of the scientist, engineer, and technologist to his or her work. Studies the subjective side of technology and the social and psychological dimensions of technological change. Students write about specific objects and their role in their lives—memoir fragments. Readings concern child development theory and the role of technology in development. Explores the connection between material culture, identity, cognitive and emotional development.  
S. Turkle

ST.044 Technology and Self: Things and Thinking  
(Subject meets with STS.444)  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: U (Spring)  
2-0-7 HASS  
Explores emotional and intellectual impact of objects. The growing literature on cognition and “things” cuts across anthropology, history, social theory, literature, sociology, and psychology and is of great relevance to science students. Examines the range of theories, from Mary Douglas in anthropology to D. W. Winnicott in psychoanalytic thinking, that underlies “thing” or “object” analysis.  
S. Turkle

ST.045 Technology and Experience (New)  
Prereq: —  
U (Fall)  
3-0-9 HASS  
Considers how contemporary consumer technologies affect aspects of our human experience. How the internet transforms our experience of time, space, and social engagement; how entertainment media affects attention, emotion, and creativity; how medical technologies alter the experience of illness, reproduction and mortality; and how pharmaceuticals regulate or enhance our experience of identity, mood, pain and pleasure. Draws on scholarship in anthropology and science and technology studies. Frequent class discussion of weekly readings and films, with midterm and short written assignments.  
N. Schull

ST.046] The Science of Race, Sex, and Gender  
(Same subject as SP.640J)  
Prereq: —  
U (Fall)  
3-0-9 HASS, CI-H  
See description under subject SP.640J.  
A. Sur

ST.048 African Americans in Science, Technology, and Medicine  
Prereq: —  
U (Spring)  
3-0-9 HASS  
A survey of the contributions of African Americans to science, technology, and medicine from colonial times to the present. Explores the impact of concepts, trends, and developments in science, technology, and medicine on the lives of African Americans. Examples include the eugenics movement, the Tuskegee Syphilis Experiment, the debate surrounding racial inheritance, and IQ testing.  
K. Manning

ST.051 Introduction to Social Studies of Finance (New)  
Prereq: —  
U (Fall)  
3-0-9 HASS  
Introduction to a rapidly growing literature in new economic sociology, social studies of finance and an anthropology of markets. The more recent interest for these modalities has cast new light on the role of technologies, theories and models in the creation of new markets. Review and discussion of these new studies with economics on the question of technologies in markets. Enrollment limited to 25.  
V. Lepinay

ST.060] The Anthropology of Biology (New)  
(Same subject as 21A.355J)  
Prereq: —  
U (Fall)  
3-0-9 HASS  
See description under subject 21A.355J.  
S. Helmreich

ST.062] Drugs, Politics, and Culture  
(Same subject as 21A.344J)  
Prereq: —  
U (Spring)  
3-0-9 HASS  
See description under subject 21A.344J.  
D. Goodman
STS.065 The Anthropology of Sound (New)
(Same subject as 21A.360J, CMS.710J)
Prereq: —
Acad Year 2007–2008: U (Spring)
Acad Year 2008–2009: Not offered
3-0-9 HASS
See description under subject 21A.360J.
S. Helmreich

STS.068 Neuroscience and Society (New)
Prereq: —
U (Spring)
3-0-9 HASS
Explores the social relevance of emerging neuroscience.
Research. How does neuroscience lend itself to new understandings of society and
ew kinds of intervention in social domains such as education, consumption, and law? Each
week focuses on a different aspect of neuroscience.
Topics include neuroimaging, neuroeconomics, neuromarketing, neuroethics, neuropsychopharmacology, and the legal recasting of social problems such as
addiction. Guest lectures, collective class discussion, and weekly readings that draw from anthropology and science studies, popular media, and
and scientific research.
N. Schull

STS.072J Nuclear Forces and Missile Defenses
(Same subject as 17.475J)
(Subject meets with 17.476J, STS.435J)
Prereq: —
Acad Year 2007–2008: U (Fall)
Acad Year 2008–2009: Not offered
3-0-9 HASS
See description under subject 17.475J.
T. Postol

STS.073 Technology and Politics in the
Acquisition of Military Systems
(Subject meets with STS.421)
Prereq: —
U (Fall)
3-0-9 HASS
Examines the technical factors that make weapons and military forces effective and the
increasingly countervailing influence of political, economic, and bureaucratic forces that often
lead to weapons of both greater cost and lower effectiveness. Examines the challenges in evalu-
atng technology maturity. Discusses defense spending and the role of the military-industrial
complex. Case studies include the F-22 Raptor; MX long-range ballistic missile; missile defense
systems, such as the Airborne Laser; the future
Combat System. Students choose, study, and
write on their own case studies.
T. Postol, S. Ghoshroy

STS.075J Technology and Culture
(Same subject as 21A.340J)
Prereq: —
U (Spring)
3-0-9 HASS
See description under subject 21A.340J.
Staff

STS.076J Technology and Policy of Weapons
Systems
(Same subject as 17.477J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Fall)
3-0-9 HASS
Examines in detail the technology of nuclear weapons systems. Topics include nuclear weapons
design, effects, targeting, and delivery; ballistic and air breathing missile propulsion and
guidance; communications and early warning techniques and systems; and anti-missile, air,
and submarine systems. Combines the discussion of technical materials with the national
security policy issues raised by the capabilities of these technologies. Considers security issues
from the distinct and often conflicting perspectives of technologists, military planners, and
political leaders. Fulfills the undergraduate public policy requirement in the Political Science
major and minor.
T. Postol

STS.082J Science, Technology, and Public Policy
(Same subject as 17.31J)
Prereq: —
U (Fall)
3-0-9 HASS, CI-H
See description under subject 17.31J.
K. Oye

STS.085 Ethics and the Law on the Electronic
Frontier
(Subject meets with 6.805, STS.487)
Prereq: Permission of instructor
U (Fall)
3-0-9 HASS
Studies the growth of computer and communications technology and the new legal and
ethical challenges that reflect tensions between individual rights and societal needs. Topics
include computer crime; intellectual property restrictions on software; encryption, privacy,
and national security; academic freedom and free speech. Students meet and question tech-
nologists, activists, law enforcement agents,
journalists, and legal experts. Extensive use of
the internet for readings and other materials.
6.805 may be used as an Engineering Concentra-
et Elective. Enrollment is limited.
H. Abelson, M. Fischer

STS.086J The Anthropology of Computing
(Same subject as SP.484J, 21A.350J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
See description under subject 21A.350J.
S. Helmreich

STS.087 Biography in Science
Prereq: —
U (Spring)
3-0-9 HASS
An examination of biography as a literary genre
to be employed in the history of science. The
use of biography in different historical periods
to illuminate aspects of the development of science.
A critical analysis of autobiography, archival sources, and the oral tradition as
materials in the construction of biographies of
scientists. Published biographies of scientists constitute the major reading, but attention is
given to unpublished biographical sources as well. Comparison is drawn between biography
d as a literary form in the history of science and in
other disciplines.
K. Manning

STS.088 Food, Culture and History
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: U (Spring)
3-0-9 HASS
Considers the ways and means by which the
foods we eat have changed since the mid-19th
century, and the reasons for its transformations.
Focuses on the role of technology and science.
Topics include agriculture and farming, fast food
and slow food, effect of wars on food technolo-
gies, the food processing industry, restaurant
culture, food taboos, diet and nutrition in
culture, and the international food trade.
D. Fitzgerald
Special Topics

STS.091 Capstone Seminar in STS Studies I
Prereq: One STS HASS-D subject or permission of instructor
U (Fall)
2-0-7 HASS

Analysis of current events and issues from the perspective of STS studies. Read classic works in STS; frequent short writing assignments; discussions and oral presentations; independently defined research project.

Staff

STS.092 Capstone Seminar in STS Studies II
Prereq: One STS HASS-D subject or permission of instructor
U (Spring)
2-0-7 HASS

Analysis of current events and issues from the perspective of STS studies. Read classic works in STS; frequent short writing assignments; discussions and oral presentations; independently defined research project.

Staff

STS.UR Undergraduate Research
Prereq: —
U (Fall, Spring)
Units arranged [P/D/F]
Can be repeated for credit

STS.URG Undergraduate Research
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

Undergraduate research opportunities in the STS Program.

Staff

STS.095, STS.096 Special Topics in Science, Technology, and Society
Prereq: —
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit

For students who wish to pursue special studies or projects with a member of the Program in Science, Technology, and Society.

Staff

STS.ThT Undergraduate Thesis Tutorial
Prereq: —
U (Fall, Spring)
1-0-5
Can be repeated for credit

Definition and early-stage work on thesis project leading to STS.ThU. Taken during first term of student’s two-term commitment to thesis project. Student works closely with STS faculty tutor. Required of all candidates for an STS degree.

Staff

STS.ThU Undergraduate Thesis
Prereq: STS.ThT
U (Fall, Spring)
Units arranged
Can be repeated for credit

Completion of work of the senior major thesis under the supervision of a faculty tutor. Includes gathering materials, preparing draft chapters, giving an oral presentation of thesis progress to faculty evaluators early in the term, and writing and revising the final text. Students meet at the end of the term with faculty evaluators to discuss the successes and limitations of the project. Required of all candidates for an STS degree.

Staff

GRADUATE SUBJECTS

Required Introductory Subjects

STS.210J Theories and Methods in the Study of History
(Same subject as 21H.991J)
Prereq: Permission of instructor
G (Fall)
3-0-9
See description under subject 21H.991J.

P. C. Perdue

STS.250J Social Theory and Analysis
(Same subject as 21A.750J)
Prereq: —
G (Fall)
3-0-9
See description under subject 21A.750J.

M. Fischer

STS.260 Introduction to Science, Technology, and Society
Prereq: —
G (Fall)
3-0-9

Intensive reading and analysis of major works in historical and social studies of science and technology. Introduction to current methodological approaches, centered around two primary questions: how have science and technology evolved as human activities, and what roles do they play in society? Preparation for graduate work in the field of science and technology studies and introduction to research resources and professional standards.

D. Mindell, V. Lepinay

Foundation Subjects

STS.310 History of Science
Prereq: Permission of instructor
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

Intensive reading and analysis of key works in the history and historiography of science. Introduces students to basic interpretive issues, bibliographic sources, and professional standards. Topics change from year to year.

S. Gerovitch

STS.320J Environmental Conflict and Social Change
(Same subject as 21A.800J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Explores the complex interrelationships among humans and natural environments, focusing on non-western parts of the world in addition to Europe and the United States. Use of environmental conflict to draw attention to competing understandings and uses of “nature” as well as the local, national and transnational power relationships in which environmental interactions are embedded. In addition to utilizing a range of theoretical perspectives, subject draws upon a series of ethnographic case studies of environmental conflicts in various parts of the world.

C. Walley
Advanced Seminars

STS.401J Qualitative Research Methods
(Same subject as 15.349J, 21A.760J)
Prereq: —
G (Spring)
3-0-9
See description under subject 21A.760J.
S. Silbey

STS.410J Reading Seminar in American History, 1877 to the Present
(Same subject as 21H.952J)
Prereq: STS.210J/21H.991J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 21H.952J.
M. Jacobs

STS.415J Nature, Environment, and Empire
(Same subject as 21H.968J)
Prereq: 21H.991J/STS.210J
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 21H.968J.
H. Ritvo

STS.421J Technology and Politics in the Acquisition of Military Systems
(Subject meets with STS.073)
Prereq: Permission of instructor
G (Fall)
3-0-9
Examines the technical factors that make weapons and military forces effective and the increasingly countervailing influence of political, economic, and bureaucratic forces that often lead to weapons of both greater cost and lower effectiveness. Examines the challenges in evaluating technology maturity. Discusses defense spending and the role of the military-industrial complex. Case studies of weapon systems include the F-22 Raptor; MX long-range ballistic missile; the B-2 strategic bomber; missile defense systems from the 1980s to the present; laser weapons including the Mid Infrared Laser (MIRACL), space based (SBL) and such as the Airborne Laser (ABL) systems; the Future Combat System; and the Bradley Fighting Vehicle. Students choose, analyze, and report on own case studies.
T. Postol, S. Ghoshroy

STS.330J History and Anthropology of Medicine and Biology
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Explores recent historical and anthropological approaches to the study of medicine and biology. Topics might include interaction of disease and society; science, colonialism, and international health; impact of new technologies on medicine and the life sciences; neuroscience and psychiatry; race, biology and medicine. Specific emphasis varies from year to year.
D. Jones

STS.340J Introduction to the History of Technology
(Same subject as ESD.52J)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit
Introduction to the consideration of technology as the outcome of particular technical, historical, cultural, and political efforts, especially in the US during the 19th and 20th centuries. Topics include industrialization of production and consumption, development of engineering professions, the emergence of management and its role in shaping technological forms, the technological construction of gender roles, and the relationship between humans and machines.
D. Mindell

STS.350J Social Study of Science and Technology
(Same subject as 21A.810J)
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Intensive reading and analysis of key works in the theory and methods of the social study of science and technology. Aims at understanding the different questions social scientists have posed in exploring how cultural context and norms influence the work of scientists and engineers. Students read works in the philosophy and sociology of science, the anthropology of laboratory culture, the feminist critique of science, political economic and policy analyses of biotechnology, and in rhetoric of scientific texts.
S. Helmreich

STS.360J Ethnography
(Same subject as 21A.820J)
Prereq: STS.250J/21A.750J
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
A practicum-style course in anthropological methods of ethnographic fieldwork and writing, intended especially for STS, CMS, HTC, and Sloan graduate students, but open to others with permission of instructor. Depending on student experience in ethnographic reading and practice, the subject is a mix of reading anthropological and science studies ethnographies; and formulating and pursuing ethnographic work in local labs, companies, or other sites.
M. Fischer

STS.380J Methods for Graduate Research in the Social Sciences
(Same subject as 21A.860J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Foundations of good empirical research in the social sciences. Introduction to the basic assumptions and underlying logic of both quantitative and qualitative methodologies. Explore a variety of approaches to research design, evaluate the products of empirical research, and practice several common techniques. Students develop a framework for their own research project.
S. Silbey, A. McCants

STS.390J Research Seminar in Science, Technology, and Society
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Designed to prepare students to write a piece of original scholarship in historical or social studies of science and technology. Students select a research topic and conduct preliminary research (including identifying potential primary sources, data, and appropriate methodology) before the semester begins. Students practice crafting constructive criticism of their peers’ work-in-progress. Students complete an original article of publishable quality by the conclusion of the seminar.
Staff

STS.400J Ethnography
(Same subject as 21A.820J)
Prereq: STS.250J/21A.750J
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
A practicum-style course in anthropological methods of ethnographic fieldwork and writing, intended especially for STS, CMS, HTC, and Sloan graduate students, but open to others with permission of instructor. Depending on student experience in ethnographic reading and practice, the subject is a mix of reading anthropological and science studies ethnographies; and formulating and pursuing ethnographic work in local labs, companies, or other sites.
M. Fischer

Advanced Seminars

STS.401J Qualitative Research Methods
(Same subject as 15.349J, 21A.760J)
Prereq: —
G (Spring)
3-0-9
See description under subject 21A.760J.
S. Silbey

STS.410J Reading Seminar in American History, 1877 to the Present
(Same subject as 21H.952J)
Prereq: STS.210J/21H.991J
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit
See description under subject 21H.952J.
M. Jacobs

STS.415J Nature, Environment, and Empire
(Same subject as 21H.968J)
Prereq: 21H.991J/STS.210J
Acad Year 2007–2008: G (Spring)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit
See description under subject 21H.968J.
H. Ritvo

STS.421J Technology and Politics in the Acquisition of Military Systems
(Subject meets with STS.073)
Prereq: Permission of instructor
G (Fall)
3-0-9
Examines the technical factors that make weapons and military forces effective and the increasingly countervailing influence of political, economic, and bureaucratic forces that often lead to weapons of both greater cost and lower effectiveness. Examines the challenges in evaluating technology maturity. Discusses defense spending and the role of the military-industrial complex. Case studies of weapon systems include the F-22 Raptor; MX long-range ballistic missile; the B-2 strategic bomber; missile defense systems from the 1980s to the present; laser weapons including the Mid Infrared Laser (MIRACL), space based (SBL) and such as the Airborne Laser (ABL) systems; the Future Combat System; and the Bradley Fighting Vehicle. Students choose, analyze, and report on own case studies.
T. Postol, S. Ghoshroy
STS.423 Technology in the Civil War Era
(Subject meets with 21H.116J, STS.029J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

A broad-ranging introduction to the American Civil War that uses technology and technological change as the primary units of analysis. Particular emphasis placed on the industrialization of warfare and its larger impact in the postwar period. Seminar organized around weekly readings. Topics include transportation (rail and wagon), communications (telegraphy), manufacturing (armaments, clothing, shoes, drugs), food production (grains and canned goods), battlefield surgery and medical care.
M. R. Smith

STS.424 Classics in the History of Technology
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

A reading seminar that complements STS.340 by scrutinizing older works that continue to influence the field. Among the authors whose works are treated are Lewis Mumford, Louis Hunter, Lynn White, Leo Marx, Brooke Hindle, Hugh Aitken, John S. Kasson, David F. Noble, and Ruth S. Cowan.
M. R. Smith

STS.428 Technology and Change in Rural America
Prereq: STS.210J, 21H.991, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
3-0-9 H-LEVEL Grad Credit

Considers the historical dimensions of rural production from subsistence to industrialization, both in America and in an international context, with an emphasis on the role of science and technology. Topics include changing notions of progress; emergence of genetics and its complex applications to food production; mechanization of both farm practices and the food industry; role of migrant labor; management theory and its impact on farm practice; role of federal governments and NGOs in production systems; women in food production systems; and the green revolution.
D. Fitzgerald

STS.429 Food and Power in the Twentieth Century
Prereq: STS.210, 21H.991, or permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

Historical analysis of food production, processing, and consumption in America. Emphasis on the social and technical practices of raising crops and livestock; efforts to preserve as well as create new foods; the industrialization of food; the role of ethnicity and gender in consumption patterns; the relation between food supply and the state; the historical and cultural context of eating. STS.428 strongly recommended as a prerequisite, but not required.
D. Fitzgerald

STS.435J Nuclear Forces and Missile Defenses
(Subject meets with 17.476J)
Prereq: Permission of instructor
Acad Year 2007–2008: G (Fall)
Acad Year 2008–2009: Not offered
3-0-9 H-LEVEL Grad Credit

See description under subject 17.476J.
T. Postol

STS.436 Cold War Science
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9

Examines the history and legacy of the Cold War on American science. Explores scientists’ new political roles after World War II, ranging from elite policy makers in the nuclear age to victims of domestic anti-Communism. Also examines the changing institutions in which the physical sciences and social sciences were conducted during the postwar decades, investigating possible epistemic effects on forms of knowledge. Subject closes by considering the place of science in the post–Cold War era. Open to undergraduates with permission.
D. I. Kaiser

STS.443 Technology and Self I
(Subject meets with STS.043)
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
2-0-7 H-LEVEL Grad Credit

Explores aspects of this topic in conjunction with ongoing activities of the MIT Initiative on Technology and Self, which looks at the social and psychological dimensions of our increasingly intimate relationship with technology. These may include seminars with psychologists and psychiatrists on child and adult clinical cases, the study of the way objects carry ideas, and the ways in which robotics, psychopharmacology, and genomics affect thinking about mind. Graduate students complete additional assignments.
S. Turkle

STS.445J Technologies for Creative Learning
(Subject meets with MAS.714J)
Prereq: Permission of instructor
G (Fall)
2-0-7 H-LEVEL Grad Credit

See description under subject MAS.714J.
M. Resnick

STS.447 Relational Machines (New)
(Subject meets with MAS.751J)
Prereq: Permission of instructor
G (Spring)
2-0-7 H-LEVEL Grad Credit

See description under subject MAS.751J.
C. Breazeal, S. Turkle

STS.449 Social Studies of Biosci and Biotech
(Subject meets with HST.930J)
Prereq: —
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Fall)
G (Fall)
2-0-1 [P/D/F]

See description under subject HST.930J.
M. M. Fischer, B. J. Good, M. D. Good
ST5.451] Representing Reality: Theories and Production of Documentary Film and Video (New)  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Summer)  
3-0-9

Explores theories and production of documentary film and video-making. Topics include how documentaries encapsulate or contest commonplace meanings of reality and truth in everyday life; how the historical use of visual technologies have alternately built upon and contested positivistic scientific understandings; and how historical transformations in film and video technologies periodically restructure the nature of documentary filmmaking, reshaping understandings of everyday truth in the process. Assignments in written and production-oriented exercises.

C. Walley, C. Boebel

ST5.461] Integrating Doctoral Seminar on Emerging Technologies  
Prereq: —  
G (Spring)  
2-0-7 H-LEVEL Grad Credit  
See description under subject ESD.85J.

K. Oye

ST5.462] Social and Political Implications of Technology  
Prereq: —  
G (Spring)  
3-0-9

Historical and contemporary studies are used to explore the interaction of technology with social and political values. Emphasis on how technological devices, structures, and systems influence the organization of society and the behavior of its members. Examples drawn from the technologies of war, transportation, communication, production, and reproduction.

M. R. Smith

ST5.464] Intellectual History of Technology  
Prereq: —  
G (Spring)  
3-0-9

An exploration of the various sectors of industrializing 19th- and 20th-century Western society and culture with a view to explaining and assessing the emergence of technology as a pivotal word (and concept) in contemporary (especially Anglo-American) thought and expression.

R. H. Williams

ST5.465 Research Seminar in the History of Science and Technology  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
3-0-9 H-LEVEL Grad Credit

A methods-oriented research seminar for graduate students who are planning careers in the history of science or technology. Emphasis on exemplary styles of research and writing, bibliographic research methods, strategies for selecting research topics, and preparing a working bibliography. Seminar culminates with presentation and critique of papers in the spring term.

M. R. Smith, D. I. Kaiser

ST5.471] Engineering Apollo: The Moon Project as a Complex System  
Prereq: Permission of instructor  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Spring)  
3-0-9 H-LEVEL Grad Credit

A detailed technical and historical exploration of the Apollo project to fly humans to the moon and return them safely to earth as an example of a complex engineering system. Emphasis is on how the systems worked, the technical and social processes that produced them, mission operations, and historical significance. Guest lectures by MIT-affiliated engineers who contributed to and participated in the Apollo missions. Students work in teams on a final project analyzing an aspect of the historical project to articulate and synthesize ideas in engineering systems.

D. Mindell, L. R. Young

ST5.477] Writing: Science, Technology, and Society  
Prereq: ST5.210J/21H.991J  
G (Spring)  
3-0-9 H-LEVEL Grad Credit

Examination of different "voices" used to consider issues of scientific, technological, and social concern. Students write, choose and among a variety of non-fiction forms: historical writing, social analysis, political criticism, and policy reports. Instruction in expressing ideas clearly and in organizing a thesis-length work. Reading and writing on three case studies drawn from the history of science; the cultural study of technology and science; and policy issues.

K. Manning

ST5.482] Science, Technology, and Public Policy  
Prereq: Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit

See description under subject 17.310J.

K. Oye

ST5.486] Bridging the Digital Divide: Information Technology and Development  
Prereq: —  
Acad Year 2007–2008: Not offered  
Acad Year 2008–2009: G (Fall)  
3-0-9

Information technology (IT) is intended to alleviate poverty, help poor people meet fundamental needs, rectify injustices, reduce corruption, and enable citizens of developing countries to assert their fundamental rights. But no agreed-upon theoretical framework justifies this enthusiasm, and a number of critiques have emerged. Equally important, there are virtually no empirical studies of the effectiveness of introducing sophisticated information technologies into developing countries. First half of subject examines theoretical arguments, pro and con, about IT for development. Second half focuses on case studies, primarily from South Asia. Open to undergraduates with permission.

K. Keniston

ST5.487] Ethics and the Law on the Electronic Frontier  
Prereq: Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit

Studies the growth of computer and communications technology and the new legal and ethical challenges that reflect tensions between individual rights and societal needs. Topics include computer crime; intellectual property restrictions on software; encryption, privacy, and national security; academic freedom and free speech. Students meet and question technologists, activists, law enforcement agents, journalists, and legal experts. Extensive use of the internet for readings and other materials. Enrollment is limited.

H. Abelson, M. Fischer
STS.488 Technoscientific Imaginaries
Prereq: Permission of instructor
Acad Year 2007–2008: Not offered
Acad Year 2008–2009: G (Spring)
3-0-9 H-LEVEL Grad Credit

The imaginaries that motivate scientific and engineering endeavors are explored with subjective theories, literature, ethnographies of laboratories and communities of scientists as well as interviews with scientists and engineers. New tools of analysis such as set theory and topology in the theories of Levi-Strauss and Jacques Lacan, the translations between science and humanities in the work of Michel Serres, or the biology in Tolkien as read by evolutionary biologist Henry Gee. Autobiography, short story, novel, film, investigative journalism, the interview, social history, and ethnography provide the texts. Open to undergraduates working in labs with permission of the instructor.  
*M. Fischer*

Research

**STS.901–910 Advanced Topics in Science, Technology, and Society**
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

For students who wish to pursue special studies or projects at an advanced level with a member of the Program in Science, Technology, and Society.  
*Staff*

**STS.ThG Graduate Thesis**
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit

Program of research leading to the writing of a PhD thesis, to be arranged by the student with an appropriate MIT faculty member, who is the thesis supervisor.  
*Staff*
Introduction to Modeling and Simulation
(Offered under: 1.021, 2.088, 3.021, 10.333, 18.361, 22.00, HST.558)
Prereq: 18.03
U (Spring)
3-0-9 REST

Basic concepts of computer modeling in science and engineering using discrete particle systems and continuum fields. Techniques and software for statistical sampling, simulation, data analysis and visualization. Use of statistical, quantum chemical, molecular dynamics, Monte Carlo, mesoscale and continuum methods to study fundamental physical phenomena encountered in the fields of computational physics, chemistry, mechanics, materials science, biology, and applied mathematics. Applications drawn from a range of disciplines to build a broad-based understanding of complex structures and interactions in problems where simulation is on equal footing with theory and experiment. Term project allows development of individual interests. Student mentoring by a coordinated team of participating faculty from across the Institute.

M. Bazant, N. Hadjiconstantinou, L. Mirny, R. Radovitzky, R. Rosales, B. Trout, F. J. Ulm, J. White, S. Yip

Inventions and Patents
(Offered under: 3.172, 6.901, 16.652)
Prereq: 14.02
U (Fall)
3-0-6

History of private and public rights in scientific discoveries and applied engineering, leading to the development of worldwide patent systems. The classes of invention protectable under the patent laws of the US, including the procedures for protecting inventions in the Patent Office and the courts. Reviews of past cases involving inventions and patents in (a) the chemical process industry and medical pharmaceutical, biological, and genetic-engineering fields; (b) devices in the mechanical, ocean exploration, civil, and/or aeronautical fields; (c) the electrical, computer, software, and electronic areas, including key radio, solid-state, computer and software inventions; and also (d) software protection afforded under copyright laws. Conducting periodic joint real-time class sessions and discussions by video-audio Internet conferencing, with other universities. Enrollment limited.

R. H. Rines

Management in Engineering
(Subject meets with 2.961, 6.930], 10.806], 16.653])
Prereq: —
U (Fall)
3-1-8

Introduction and overview of engineering management. Financial principles, management of innovation, technical strategy and best management practices. Case study method of instruction emphasizes participation in class discussion. Focus is on the development of individual skills and management tools. Juniors or seniors.

A. V. d’Arbeoff, J.-H. Chun

Engineering Risk-Benefit Analysis
(Offered under: 1.155, 2.963, 3.577, 6.938, 10.816, 16.862, 22.82, ESD.72)
Prereq: 18.02
G (Spring)
3-0-9 H-LEVEL Grad Credit

Emphasis on three methodologies pertaining to decision making in the presence of uncertainty: reliability and probabilistic risk assessment (RPRA), decision analysis (DA), and cost-benefit analysis (CBA). Risks of particular interest are those associated with large engineering projects such as the development of new products, the building, maintenance and operation of nuclear reactors and space systems. Presents and interprets some of the frameworks helpful for balancing risks and benefits in the situations that typically involve human safety, potential environmental effects, and large financial and technological uncertainties. Review of elementary probability theory and statistics included.

G. E. Apostolakis

Engineering Systems Analysis for Design
(Offered under: 1.146, 3.56, 16.861, ESD.71)
Prereq: 1.145] or permission of instructor
G (Fall)
3-0-6 H-LEVEL Grad Credit

See description under subject ESD.71.

R. de Neufville

Applications of Technology in Energy and the Environment
(Offered under: 1.149, 2.63, 5.00, 10.579, 22.813, ESD.174)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit

Introduces advanced undergraduates or graduate students in the Schools of Engineering and Science to the integration of technical, economic, political, and environmental consideration required for the successful implementation of new technology. Case studies are drawn from the energy and environment sectors with some emphasis on analytic techniques that serve as a “tool box” for students. Technologies considered include fossil, nuclear, solar, wind, fuel cell and energy conservation. International aspects, such as weapons proliferation and global climate effects, also discussed. Enrollment limited.

J. Deutch, R. Lester

UPOP IAP Workshop
(Offered under: 1.EPW, 2.EPW, 3.EPW, 6.EPW, 10.EPW, 16.EPW, 22.EPW)
Prereq: —
U (IAP)
3-0-0 [P/D/F]

Provides engineering sophomores the opportunity to build the core foundation of skills necessary to succeed in and prepare for a summer practice experience. Introduces concepts in product development, system dynamics, organizational dynamics, and effective communication. Also introduces concepts in ethics and character, and leadership and teamwork to ensure that students acquire an appreciation of the social, environmental, and ethical implications of organizational decision making. Subject is an interactive experience integrating lectures with role-playing, simulations, and group projects, where students apply these concepts in a case study context. Students are provided with a journal to be used during their summer training practice. Limited enrollment.

D. K.P. Yue
UPOP Summer Practice Experience
(Offered under: 1.EPE, 2.EPE, 3.EPE, 10.EPE, 16.EPE, 22.EPE)
Prereq: 2.EPW or permission of instructor
U (Fall, Spring)
0-1-0 [P/D/F]
Can be repeated for credit
Provides engineering students, typically sophomores, the opportunity to participate in engineering practice. Students gain experience with recruitment and job selection, the job experience, and the assessment and reflection process. Spring term includes seminars and workshops in preparation for internship and management of career path. With the assistance of UPOP staff, students find and engage in a 10-12 week summer job experience, during which they maintain a journal of their experiences. In the Fall term, students write essays addressing the topics introduced in UPOP EPW workshop during IAP, complete a post-summer self-evaluation form, and discuss these forms with their regular academic advisor. Students have the opportunity to share their experiences with others in a roundtable discussion. Can be taken up to two times for credit. Spring term can only be taken in conjunction with the fall term.
D. K.P. Yue

UPOP Reflective Learning Experience
(Offered under: 1.EPR, 2.EPR, 3.EPR, 10.EPR, 16.EPR, 22.EPR)
Prereq: 2.EPE or permission of instructor
U (Fall)
0-0-3 [P/D/F]
Provides engineering sophomores the opportunity to reflect and share their summer practice experiences as related to the topics of the IAP subject and students’ academic subjects through a written report and an oral presentation delivered at a UPOP symposium in the fall.
D. K.P. Yue

Innovation Teams
(Same subject as 15.371J)
Prereq: Permission of instructor
G (Fall, Spring)
3-2-4
Innovation teams of science, engineering, and management students evaluate the commercial feasibility of research generated by grants to School of Engineering faculty by the Deshpande Center for Technological Innovation. Projects cover critical aspects of commercialization such as developing an intellectual property strategy, performing competitive analysis, selecting the target market and application, identifying the appropriate business model for commercialization, designing a go-to-market plan, and choosing the sales approach to garner initial customers. Lectures address key issues of technology transfer, new venture creation, and commercialization. Students develop strong skills in communication and working in teams. Résumé and application including a brief statement of objectives are required in advance of registration to enable the best match of students with projects.
C. Cooney, E. Roberts, K. Zolot